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Prenatal Alcohol Consumption:

A Risk-Protective Model

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Prenatal Alcohol Consumption:

A Risk-Protective Model

by

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Prenatal Alcohol Consumption:

A Risk-Protective Model

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Significant numbers of women continue to consume alcohol while pregnant despite evidence of a range of possible serious consequences. Experts agree that a better understanding of the factors that influence this behavior is needed in order to develop more effective prevention strategies. However, research to date is often based on nonrepresentative samples and has failed to take a comprehensive, theory-driven approach to examining risk and protective factors.

Based on a review of the literature, a risk-protective model of prenatal alcohol consumption, containing four domains of influence – individual risk,

social/environmental risk, individual protective, and social/environmental protective – was developed. Data from the 2001 and 2002 National Survey on Drug Use and Health (NSDUH), formerly the National Household Survey on Drug Abuse, was then used to test this model to identify those domains, as well as specific predictors within each domain, that appear to be most influential at promoting or prohibiting alcohol consumption during pregnancy. Differences among White, Hispanic, and Black respondents were also explored.

Findings from this study build upon prior research, confirming that certain risk factors are associated with a greater likelihood of drinking during pregnancy, as well as represent a starting point for the identification of factors that may actually help pregnant females refrain from consuming alcohol.

Based on data from 1,814 pregnant females, the individual risk domain emerged as the most influential in predicting alcohol use during pregnancy, with cigarette smoking remaining a significant predictor across all three ethnic subgroups studied. A variable in the social/environmental risk domain, which was related to alcohol consumption among one's social network, was significant among Hispanic respondents and spirituality, an individual protective domain factor, was associated with a decreased risk for alcohol use among Black pregnant females.

Implications for future research, continued development of theory-based

models of prenatal alcohol use, professional practice with childbearing aged women, and national and institutional policy, are also discussed.

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Chapter 1

Statement of the Problem

Although the use of substances, such as marijuana, cocaine, and cigarettes, during pregnancy can pose serious harm to a developing fetus, the effects of alcohol are far greater than those of any other substance (Stratton, Howe, & Battaglia, 1996). Despite a variety of prevention efforts, significant numbers of women continue to engage in this behavior, making prenatal alcohol consumption an important public health issue and the development of effective prevention strategies a national research priority (U.S. Department of Health and Human Services [USDHHS] 1993, 1997, 1998, 2000).

This research is intended to improve prevention efforts by identifying risk and protective factors of prenatal alcohol consumption and exploring ethnic differences in these factors. To substantiate the need for this research, this chapter reviews the consequences and incidence of prenatal alcohol consumption and summarizes the research on prevention efforts and factors associated with drinking during pregnancy. Gaps in the current literature will be discussed and the specific questions posed by this study outlined.

Consequences of Prenatal Alcohol Consumption

Research now demonstrates that prenatal alcohol consumption is associated with an array of serious consequences for infants, of which the most well known is fetal alcohol syndrome (FAS). Since the discovery of FAS, over

1,000 articles have appeared in the literature on the topic, most of which have "emphasized the biochemical mechanisms of damage to the fetus, the physical characteristics of the syndrome in humans and animals, and biologic descriptions of the birth defects associated with the syndrome" (National Institute on Alcohol and Alcoholism [NIAAA] 2000b, p. 323).

Just how serious are the consequences of prenatal alcohol consumption? Not only do infants affected by alcohol face a lifetime of problems, but the costs often extend beyond these individuals, with prenatal alcohol consumption posing serious danger to the health of the mother, threatening family functioning, and resulting in significant financial costs to society. Although the following summary of the consequences of prenatal alcohol consumption is not exhaustive, it does reveal their breadth and severity.

Risks to the Fetus and Infant

Research has shown that alcohol consumption in women, regardless of age, may lead to preterm delivery (Sokol, Martier, Ager, & Janisse, 2001), which is the primary cause of low birthweight (Ventura, Martin, Matthews & Clarke, 1996). Low birthweight places an infant at increased risk for developmental delays, a variety of chronic conditions, and even death (McLean, Walters & Smith, 1993). McLean and colleagues (1993) state that almost 70% of all neonatal deaths can be attributed to preterm birth.

For infants that survive birth, one of the most noted consequences of

heavy prenatal alcohol consumption is to be born with FAS. FAS, an irreversible, yet completely preventable condition characterized by physical anomalies, growth deficiency, and brain damage caused by alcohol consumption during pregnancy, was first identified in France in 1968 (Lemoine, Harousseau, Borteyru, & Menuet, 1968). Documentation of its existence in the United States was soon to follow (Wilson, 1973). Maternal alcohol consumption is now recognized as the leading known cause of mental retardation (Stratton et al., 1996; NIAAA, 2000b, 2004).

In the U.S., rates of FAS range from 0.5 to 3 per 1,000 live births (Stratton et al., 1996), but are greater among certain populations including the Apache and Ute tribes (Abel & Sokol, 1987). The Center for Disease Control and Prevention (CDC, 1995b) reports that rates of FAS increased more than six times from 1979 to 1993. Regardless of whether this increase is due to increased incidence or better recognition by physicians, the trend is disturbing.

It is difficult to estimate the costs of FAS, but there have been some attempts to do so. According to some leading experts on the subject, the institutional care alone for individuals with FAS-related mental retardation account for 11% of the annual cost of such care in the U.S. (Abel & Sokol, 1987, p. 51). For an individual with FAS, the estimated medical and institutional lifetime costs are thought to be approximately $1.4 million (NIAAA, 2004). Clearly the economic costs of FAS alone are enormous.

While an estimated 5,000 infants are born with FAS in the United States every year, they account for only a small percentage of the children affected by in utero alcohol exposure (NIAAA, 2004). An additional 50,000 infants are born each year affected by maternal alcohol consumption, but lack all the features required of a FAS diagnosis. According to the National Organization on Fetal Alcohol Syndrome (NOFAS) website (n.d.), more infants are born with FAS or other alcohol-related problems than Down's syndrome, cystic fibrosis, spina bifida and sudden infant death syndrome combined.

Diagnostic Criteria of FAS and Alcohol-Related Effects

To help clarify issues of diagnosis surrounding alcohol-exposed infants and children, the Institute of Medicine of the National Academy of Sciences delineated five diagnostic classes of prenatal alcohol exposure, including three categories of FAS and two categories of alcohol-related effects, which are described in Table 1-1 (Stratton, et al., 1996).

Table 1-1
"Diagnostic Criteria for Fetal Alcohol Syndrome (FAS)
and Alcohol-Related Effects"

Fetal Alcohol Syndrome

1. FAS with confirmed maternal alcohol exposure[a]

A. Confirmed maternal alcohol exposure[a]

B. Evidence of a characteristic pattern of facial anomalies that includes features such as short palpebral fissures and abnormalities in the premaxillary zone (e.g., flat upper lip, flattened philtrum, and flat midface)

C. Evidence of growth retardation, as in at least one of the following:

- low birth weight for gestational age
- decelerating weight over time not due to nutrition
- disproportional low weight to height

Table 1-1 continued

D. Evidence of CNS neurodevelopmental abnormalities, as in at least one of the following:
   - decreased cranial size at birth
   - structural brain abnormalities (e.g., microcephaly, partial or complete agenesis of the corpus callosum, cerebellar hypoplasia)
   - neurological hard or soft signs (as age appropriate), such as impaired fine motor skills, neurosensory hearing loss, poor tandem gait, poor eye-hand coordination

2. FAS without confirmed maternal alcohol exposure

B, C, and D as above

3. Partial FAS with confirmed maternal alcohol exposure

A. Confirmed maternal alcohol exposure[a]
B. Evidence of some components of the pattern of characteristic facial anomalies

Either C or D or E

C. Evidence of growth retardation, as in at least one of the following:
   - low birth weight for gestational age
   - decelerating weight over time not due to nutrition
   - disproportional low weight to height
D. Evidence of CNS neurodevelopmental abnormalities, as in at least one of the following:
   - decreased cranial size at birth
   - structural brain abnormalities (e.g., microcephaly, partial or complete agenesis of the corpus callosum, cerebellar hypoplasia)
   - neurological hard or soft signs (as age appropriate), such as impaired fine motor skills, neurosensory hearing loss, poor tandem gait, poor eye-hand coordination
E. Evidence of a complex pattern of behavior or cognitive abnormalities that re inconsistent with developmental level and cannot be explained by familial background or environment alone, such as learning difficulties; deficits in school performance; poor impulse control; problems in social perception; deficits in higher level receptive and expressive language; poor capacity for abstraction or metacognition; specific deficits in mathematical skills; or problems in memory, attention, or judgment

Alcohol-Related Effects

Clinical condition in which there is a history of maternal alcohol exposure,[a,b] and where clinical or animal research has linked maternal alcohol ingestion to an observed outcome. There are two categories, which may co-occur. If both diagnoses are present, then both diagnoses should be rendered:

Table 1-1 continued

4. Alcohol-related birth defects (ARBD)

List of congenital anomalies, including malformations and dysplasias

Cardiac	Atrial septal defects	Aberrant great vessels
	Ventricular septal defects	Tetralogy of Fallot
Skeletal	Hypoplastic nails	Clinodactyly
	Shortened fifth digits	Pectus excavatum and carinatum
	Radioulnar synostosis	Klippel-Feil syndrome
	Flexion contractures	Hemivertebrae
	Camptodactyly	Scoliosis
Renal	Aplastic, dysplastic, hypoplastic kidneys	Ureteral duplication
		Hydronephrosis
	Horseshoe kidneys	
Ocular	Strabismus	Refractive problems secondary to small globes
	Retinal vascular anomalies	
Auditory	Conductive hearing loss	Neurosensory hearing loss
Other	Virtually every malformation has been described in some patient with FAS. The etiologic specificity of most of these anomalies to alcohol teratogenesis remains uncertain.	

5. Alcohol-related neurodevelopmental disorder (ARND)

Presence of:

A. Evidence of CNS neurodevelopmental abnormalities, as in at least one of the following:
   - decreased cranial size at birth
   - structural brain abnormalities (e.g., microcephaly, partial or complete agenesis of the corpus callosum, cerebellar hypoplasia)
   - neurological hard or soft signs (as age appropriate), such as impaired fine motor skills, neurosensory hearing loss, poor tandem gait, poor eye-hand coordination

   and/or:

B. Evidence of a complex pattern of behavior or cognitive abnormalities that are inconsistent with developmental level and cannot be explained by familial background or environment alone, such as learning difficulties; deficits in school performance; poor impulse control; problems in social perception; deficits in higher level receptive and expressive language; poor capacity for abstraction or metacognition; specific deficits in mathematical skills; or problems in memory, attention, or judgment

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[a]A pattern of excessive intake characterized by substantial, regular intake or heavy episodic drinking. Evidence of this pattern may include frequent episodes of intoxication, development of tolerance or withdrawal, social problems related to drinking, legal problems related to drinking, engaging in physically hazardous behavior while drinking, or alcohol-related medical problems such as hepatic disease.

[b]As further research is completed and as, or if, lower quantities or variable drinking patterns of alcohol use are associated with ARBD or ARND, these patterns of alcohol use should be incorporated into the diagnostic criteria.

Long-term Consequences for Alohol -Affected Children

Though the diagnostic criteria just presented are helpful in guiding medical treatment (Stratton et al., 1996), they do not fully describe the numerous developmental and behavioral issues that often accompany prenatal alcohol exposure. Many children exposed to alcohol in utero develop learning, language, and memory problems (Stratton et al., 1996; NIAAA, 2000b, USDHHS, 2001). For many children, the preschool and school-aged years will reveal difficulties with general intellectual and cognitive functioning (Janzen, Nanson, & Block, 1995; Mattson, Riley, Gramling, Delis, & Jones, 1998) and problems with attention (Mattson, et al., 1998; Nanson & Hiscock, 1990). One recent retrospective study of 280 individuals with attention-deficit hyperactivity disorder (ADHD) and 242 individuals without ADHD found that those with ADHD were 2.5 times more likely to have been exposed to alcohol prenatally (Mick, Biederman, Faraone, Sayer, & Kleinman, 2002).

Research on children exposed to alcohol in utero has also found that these children process information more slowly and less efficiently (Jacobson, & Jacobson, 1994). Other studies have substantiated a relationship between prenatal alcohol exposure and later behavioral problems (Autti-Ramo, 2000; Sood et al., 2001), as well as the need for special education (Autti-Ramo, 2000). While often not evident for several years, these learning and behavioral problems are considered by many to be the most devastating consequences of prenatal

alcohol consumption (NIAAA, 2000b; Streissguth, 2001).

Persons with FAS generally have mild mental retardation, but some individuals will have IQ scores in the severe range (Streissguth, 1986). Some evidence now exists that these individuals are at greater risk for internalizing disorders, such as depression and low self-esteem (Hankin, 2002) and that adults exposed to alcohol in utero often experience mental health problems and maladaptive behaviors, making it challenging for them to become self-reliant (Streissguth & O'Malley, 2000).

Risks to the Mother

Women who are heavy drinkers face many serious health risks. Among these risks are liver disease (Gavaler & Arria, 1995; Hall, 1995), high blood pressure, heart disease (Fraser, 1986), nutritional deficits, gastritis, pancreatitis and hepatitis (Center for Substance Abuse Treatment (CSAT), 1993). Any of these conditions can have negative effects on the pregnancy (Greenfield & Sugarman, 2001).

Heavy drinking women who become pregnant face additional risks. Research has shown a link between alcohol consumption during pregnancy and increased risk of miscarriage (Hawks, 1993; Kesmodel, Wisborg, Olsen, Henriksen & Secher, 2002; Streissguth, 2001; Windham, Von Behren, Fenster, Schaefer & Swan, 1997). One study found that heavy drinking women reported miscarrying 2-3 times more often than women in the general population

(Hannigan, Welch, & Sokol, 1992).

Kesmodel and colleagues (2002) reported an increased risk of miscarriage in the first trimester even for women drinking at moderate levels, defined as ≤ 5 drinks a week. This is of special concern since many women continue their usual patterns of drinking during the first trimester of pregnancy before learning they are pregnant (Stratton et al., 1996; Bowden & Rust, 2000). Women who have experienced miscarriage are at risk for depression, anxiety, and marital difficulties (Klock, Chang, Hiley & Hill, 1997) and even posttraumatic stress disorder (Englehard, van den Hout & Arntz, 2001).

Alcohol consumption during pregnancy has also been linked with preterm labor (Center for Substance Abuse Treatment, 1993; Sokol et al., 2001). In addition to risks for the infant, preterm labor can result in hospitalization or bed rest for the mother, which can mean lost income, disturbances in daily life, and increased stress (Maloni, Chance, Zhang, & Cohen 1993). Finally, Hymbaugh (1995) noted high mortality rates among women who consume alcohol during pregnancy.

Consequences to the Family and Society

In addition to the impact on the health of the child and mother, multiple other costs are associated with alcohol consumption by pregnant women. There is evidence “that children with FAS, ARBD, or ARND are more likely to have negative caregiving environments than are typical children or children with other

disabilities" (Stratton et al., p. 171). Furthermore, Streissguth (2001) notes that children "of alcoholic parents may be raised in compromised environments, removed from their families, or relinquished and raised by adoptive families" (p. 304).

The number of children of alcoholic mothers in the foster care system is a significant social cost (Schatz & Mallea, 1995). A 1994 U.S. General Accounting Office (1994) report implicated parental substance abuse in 78% of the cases involving young children in foster care. Some research has found that 80% of children with FAS or fetal alcohol effects were not raised by biological families (Streissguth, Barr, Kogan & Bookstein, 1996, 1997). More recently, Autti-Ramo (2000) also found a positive relationship between in utero alcohol exposure and the need for foster care.

Summary of Prevention Efforts

Given the extraordinary costs associated with drinking during pregnancy, the many efforts undertaken to prevent women from consuming alcohol while pregnant are not surprising. Efforts are classified as universal, selective, or indicated, depending on the nature of the message and the intended audience (Stratton et al., 1996). The following is a synopsis of the outcomes of these prevention strategies (a more thorough review of prevention strategies is included in Chapter 2).

Universal preventions are health messages aimed at the general public,

some of which contain messages to pregnant or preconceptional women (Stratton et al., 1996). Warning labels on alcoholic beverages and warning posters in restaurants are examples of universal prevention efforts. Research on the effectiveness of such efforts has shown mixed results, but generally indicates that such efforts probably result in an initial increase in the awareness of the risks associated with prenatal alcohol consumption, as well as some accompanying behavior change, but that the impact fades over time (Kaskutas & Graves, 1994; Hankin et al., 1998).

Selective preventions are health messages or interventions geared toward members of a particular subgroup, whose risk is higher as a member of that group (Stratton et al., 1996). They include efforts that target all women in their reproductive years that drink alcohol (Hankin, 2002). A handful of brief intervention trials, including those with women of childbearing age (Manwell et al., 2000) and pregnant women (Chang, 1999; Handmaker, Miller, & Manicke, 1999), have shown promise in reducing prenatal alcohol consumption, but research in this area is still in its infancy.

Indicated preventions target women known to be at high-risk of having an alcohol-affected child because they are drinking at heavy levels (Stratton et al., 1996). These efforts target women with a history of prenatal alcohol consumption and those who have given birth to an alcohol-affected child (Hankin, 2002). Although indicated prevention studies show positive results (Grant, 1996; Hankin

& Sokol, 1995; Streissguth, 1997), so few are undertaken that they cannot possibly reach all women at risk for prenatal alcohol consumption. Though selective and indicated prevention efforts are promising, research on their effectiveness is just beginning.

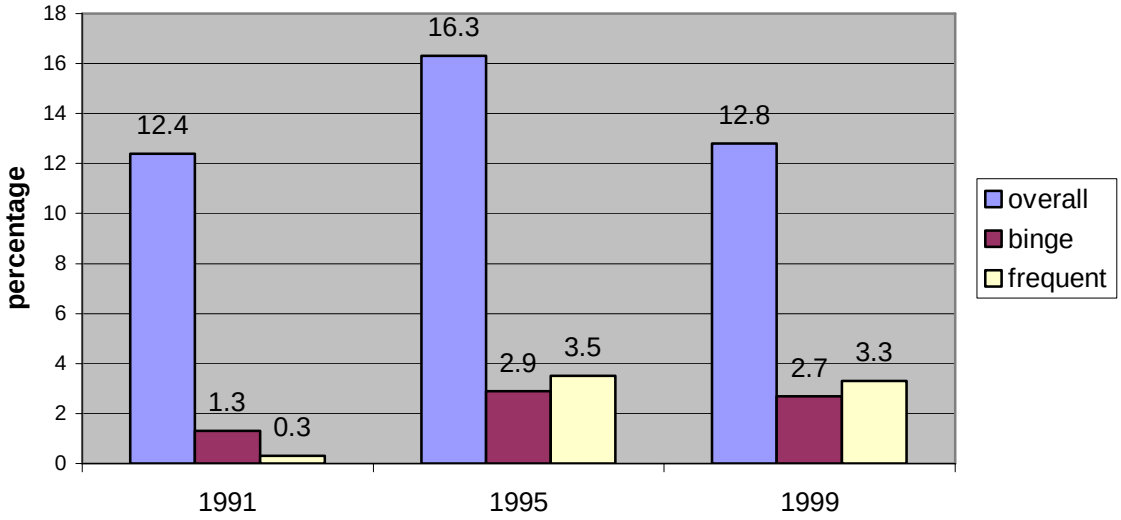
Incidence of Prenatal Alcohol Consumption

Despite the enormity of risks that may result from prenatal alcohol consumption and the implementation of a variety of prevention efforts, several reliable sources of data indicate that significant numbers of women continue to drink during pregnancy. The first large scale study to provide such data was the 1991 Behavioral Risk Factor Surveillance System (BRFSS) survey, a random telephone survey of individuals at least 18 years of age in 47 states and the District of Columbia (CDC, 1994). Among the 1,067 women who were pregnant at the time of the survey, 12.4% reported light drinking (less than 30 drinks) in the previous month, 0.1% reported moderate drinking (31-59 drinks), 1.3% reported binge drinking (five or more drinks on at least one occasion), and 0.3% reported heavy drinking (60 or more drinks).

Data from the 1995 BRFSS indicated that the rate of light drinking had increased to 16.3%, but dropped back to 12.8% in 1999 (CDC, 2002), while rates of both binge and frequent drinking (moderate, heavy and binge drinkers combined) rose from 1991 to 1995 and remain relatively stable. The rate of binge drinking among pregnant women was 2.9% in 1995 and 2.7% in 1999. The rate

of frequent alcohol use was 3.5% in 1995 and 3.3% in 1999. Although drinking less than one drink a day can negatively impact fetal growth and development (Charness, Safran, & Perides, 1994; Day, 1995; Wong, Kenwrick, Willems, &Lemmon, 1995), binge drinking and heavy drinking are clearly linked with an increased risk for FAS (Stratton et al., 1996), making these trends particularly disturbing. Trends in rates of overall, binge, and heavy drinking are depicted in Figure 1-1.

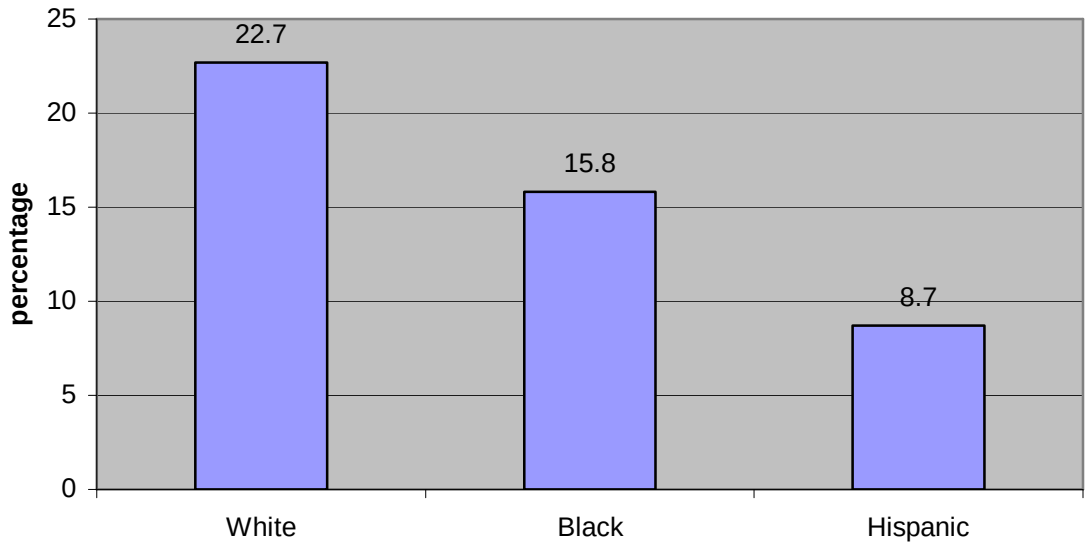
Figure 1-1
Trends in Rates of Prenatal Alcohol Consumption
Data source: BRFSS, CDC



Data from the National Pregnancy and Health Survey, collected from women who delivered an infant in 52 urban and rural hospitals during 1992, Provided the first national prevalence estimates of prenatal alcohol use, as well

as information on observed ethnic differences (National Institute on Drug Abuse [NIDA], 1995). Of the 2,613 women from whom self-report data was collected, 18.8% said they had consumed alcohol at some point during their pregnancy. As illustrated in Figure 1-2, the highest rates of consumption were seen among White women (22.7%), followed by Black women (15.8%), and Hispanic women (8.7%).

Figure 1-2
Ethnic Comparison of Prenatal Alcohol Use Rates
Data source: NIDA, 1995



The National Household Survey on Drug Abuse (NHSDA), now known as the National Survey on Drug Use and Health (NSDUH), provides the most recent nationally representative data on rates of alcohol use among pregnant women.

The 1999-2000 NHSDA indicated that 12.4% of pregnant women reported consuming alcohol in the past month (Substance Abuse and Mental Health Services Administration [SAMHSA], 2000). Binge drinking, defined as consuming five or more drinks on one occasion, was reported by 3.9% of pregnant women. Heavy drinking, defined as consuming five or more drinks on one occasion on each of five or more days, was reported by 0.7% of pregnant women.

Summary of Factors Associated with Prenatal Alcohol Consumption

A number of studies have found a variety of factors to be associated with drinking during pregnancy. The following is a synopsis of these studies (Chapter 2 contains a more thorough review of studies that have examined these factors). Data for these studies come from two distinct sources: nationally representative samples and smaller clinical samples. Nationally representative samples of pregnant women indicate that women who engage in prenatal alcohol consumption tend to be White, smoke cigarettes, use illicit drugs (NIDA, 1995), and are over 30 years of age, unmarried, and employed (CDC, 2002).

Clinical studies highlight other possible risk factors for prenatal alcohol consumption, including depression (Hanna, Faden, & DuFour, 1994; Zuckerman, Amaro, Bauchner, & Cabral, 1989), lower socioeconomic status (Testa & Leonard, 1995), greater parity (Testa & Leonard, 1995), social networks that support alcohol use (Testa & Leonard, 1995), increased anxiety (Zambrana & Scrimshaw, 1997), negative attitude toward pregnancy (Hanna et al., 1994), and

being Black (Noble et al., 1997).

Limitations of Current Research

The consequences of prenatal alcohol consumption, especially to alcohol-affected infants and children, are well documented. Data from nationally representative samples of pregnant women provide sufficient evidence of the prevalence of prenatal alcohol consumption. Beyond this, there are several gaps in the existing literature.

Both the NIAAA and the National Task Force on Fetal Alcohol Syndrome and Fetal Alcohol Effects (Task Force) have noted the lack of research using nationally representative samples that document the characteristics of women at greatest risk for drinking during pregnancy. Despite recognition that successful prevention of prenatal alcohol consumption must be based on a comprehensive picture of the risk factors associated with this behavior (Bowden & Rust, 2000; NIAAA, 2000; Stratton et al., 1996), as well as protective factors that discourage this behavior (Stratton et al., 1996), the NIAAA (2000b) maintains that only a small proportion of research in this area has addressed "the social and psychological risk factors associated with drinking during pregnancy and the birth of FAS children" (p. 323). The Task Force, organized in 1999 and operating under the auspices of the Centers for Disease Control and Prevention's (CDC) National Center on Birth Defects and Developmental Disabilities, included the need to describe women at-risk in its first set of recommendations (Weber, Floyd,

Riley, & Snider, 2002).

Although some studies have examined risk factors for prenatal alcohol consumption, much of this research has included only a limited number of predictors at a time, and studies of factors that appear to guard against women engaging in this behavior are virtually nonexistent, despite growing evidence of the importance of resiliency in understanding complex human behavior (Greene, 2002). Furthermore, many of these studies are largely based on clinical "samples of low-income women, women in drug treatment centers, women of color, and patients at inner-city public hospitals" (Finch, Vega, & Kolody, 2001, p. 572). There are major gaps in the literature because studies have not used comprehensive, integrative conceptual models and nationally representative samples to advance understanding of why some women drink during pregnancy despite enormous risks.

In addition to these gaps, the literature on prenatal alcohol consumption does not answer the questions of whether risk factors vary by ethnicity or if there are factors that may protect against drinking during pregnancy. Zambrana and Scrimshaw (1997) are the only researchers that have specifically explored differences in risk factors by ethnicity – and none have examined protective factors.

Study Questions

Successful prevention strategies must be based upon a comprehensive

picture of not only risk factors for prenatal alcohol consumption, but also those factors that appear to discourage this behavior; ideally, this picture should be based upon data from nationally representative samples (Stratton et al., 1996). Currently available data provide a starting point for developing this picture.

Data from the National Survey on Drug Use and Health (NSDUH) will be used to test and refine a risk-protective model of prenatal alcohol consumption, developed through a review of the literature on prenatal alcohol consumption and other pertinent research. In addition to looking at the population of pregnant women as a whole, ethnic differences will also be explored. Using two years of NSDUH data (2001 and 2002), a series of hierarchical logistic regression analyses will be conducted to answer the following research questions:

1. What contributions do different domains (individual vs. social/environmental risk factors and protective factors) make toward explaining variance in alcohol use among pregnant women?
2. What are the most important predictors within each of these major domains (e.g. individual risk, social/environmental risk, individual protective, social/environmental protective)?
3. Does there appear to be any difference in the contributions of each domain and/or the importance of specific predictors among women of different ethnic backgrounds?

This secondary analysis is an attempt to begin addressing gaps in the literature,

as well as issues identified by national governmental and other entities by generating information to assist healthcare professionals in identifying women at greatest risk for drinking during pregnancy and to facilitate the development of more effective prevention strategies.

Chapter 2

Literature Review

This chapter includes a critical review of efforts that have been implemented to prevent prenatal alcohol consumption, as well as studies that have examined risk factors of women who engage in this behavior.

Review of Prevention Efforts

Nationally published guidelines, as well as most physicians, urge women not to drink any alcohol during pregnancy (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 1995; 2000a). The threshold at which drinking alcohol during pregnancy is dangerous has yet to be determined, but there is growing evidence that drinking as little as one drink a day can harm fetal development (Charness, Safran, & Perides, 1994; Day, 1995; Wong, Kenwrick, Willems, & Lemmon, 1995). Since the fetus may be particularly vulnerable in early pregnancy (Center for Disease Control and Prevention (CDC, n.d.), ideally women should abstain from drinking alcoholic beverages while they are trying to become pregnant (Stratton, Howe, & Battaglia, 1996).

However, since nearly half of all pregnancies are unintended (CDC, 2002), this is not likely to occur. Although the majority of women do abstain from alcohol use, or at least substantially reduce their level of consumption, upon the discovery of pregnancy (Kaskutas, Greenfield, Lee, & Cote, 1998), a significant number of women continue to drink alcohol during pregnancy (Stratton et al.,

1996). Given the extraordinary costs associated with drinking during pregnancy, it is not surprising that many efforts to prevent women from consuming alcohol while pregnant have been undertaken.

Since a variety of prevention efforts exist, the classification system of prevention efforts proposed by the Institute of Medicine (IOM) can serve as a useful framework for reviewing such endeavors (NIAAA, 2000; Stratton et al., 1996). This classification presented by the IOM is as follows:

- Universal preventions are health messages aimed at the general public, some of which contain messages to pregnant or preconceptional women.
- Selective preventions are health messages or interventions geared toward members of a particular subgroup, whose risk is higher as a member of that group.
- Indicated preventions target women known to be at high-risk of having an alcohol-affected child because they are drinking at heavy levels.

Universal Prevention Strategies

In 1981, the Office of the Surgeon General began advising women who were pregnant, or planning to become pregnant, to refrain from drinking alcohol (U.S. Public Health Service, 1981). In 1988, the U.S. Congress passed a law intended to warn the public about the potential dangerous impact of alcohol

consumption during pregnancy, as well as possible negative health consequences and the danger of drinking while driving (U.S. Congress, 1988). This law required that all alcoholic beverage containers contain the following message:

> GOVERNMENT WARNING: (1) According to the Surgeon General, women should not drink alcoholic beverages during pregnancy because of the risk of birth defects. (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery and may cause health problems.

Since that time, several studies have investigated the effectiveness of the alcoholic beverage warning label, along with other types of universal messages, such as warning posters in restaurants.

Based on telephone interviews with nationally representatives samples of adults in 1990 (n = 2000) and 1991 (n = 2017), Kaskutas and Graves (1994) examined the effect of exposure to three types of universal messages (alcoholic beverage labels, warning signs in restaurants or bars, and advertisements on radio or television) and awareness of the risk of consuming alcohol during pregnancy and behavior related to this risk. Only 25% of childbearing aged women reported having been exposed to two types of messages, and only about 7% of childbearing aged women to all three message types. The only significant variables related to limiting alcohol consumption for health reasons were the

belief that any prenatal alcohol consumption is dangerous ($p < .05$), having been exposed to all three types of universal prevention messages ($p < .0001$), and having been pregnant in the last year ($p < .0001$). Exposure to one or two message sources, thebelief that five or more drinks at a time during pregnancy is very dangerous, education, and ethnicity did not emerge as significant predictors of consumption reduction. Based on these results, the authors concluded that multiple communication approaches are needed to reinforce messages such as the dangers of prenatal alcohol consumption.

Using a sample of over 17,000 inner-city Black pregnant women at a prenatal clinic between September 1986 and September 1993, Hankin et al. (1996) investigated the impact of the alcoholic beverage warning label on mulitparae women (those with at least one previous live birth) and nulliparae women (those with no previous live births). The researchers found that prenatal alcohol consumption significantly declined in June 1990, shortly after the implementation of the alcoholic beverage warning label, among nulliparous women ($p<.04$), but not among multiparous women, leading the authors to suggest that more intensive prevention efforts are needed for women with previous live births.

Hankin (1998) examined the impact of the alcoholic beverage warning label in 1995, six years post implementation, among 1,107 Detroit women interviewed through a random telephone survey. Thirty-nine (39%) of the total

sample (including non-drinkers) reported seeing the label in the past year compared to 52% of women who were current drinkers. Pregnant women were more likely to have been exposed to the label (58%) than non-pregnant women (38%). Exposure to the warning label increased with frequency of drinking and with drinking quantity. There was also a direct negative relationship between label exposure and age, with younger women recalling seeing the label more. No relationship to label exposure was found with marital status or race, nor were education or income significant predictors of exposure.

In 1998, Kaskutas and colleagues investigated the relationships between prenatal alcohol consumption and exposure to four types of prevention messages (alcoholic beverage warning labels, point of sale signs, advertisements, and personal conversations) using data from a five year (1989 through 1994) cross-sectional U. S. national survey (pooled n = 9800) and a two year (1993, n = 1050; 1994, n = 686) longitudinal study of women aged 18– 40 years. Results indicated that exposure to warning labels among women pregnant in the past year, and those likely to become pregnant in the next 5 years did increase over time, but no association was found between changes in alcohol consumption during pregnancy and exposure to the warning label.

Kaskutas and colleagues (1998) also found that exposure to warning signs varied over time, while personal conversations about the dangers of drinking alcohol during pregnancy and exposure to advertisements actually

declined over time. The researchers found no significant relationship between changes in prenatal alcohol consumption and any of these message sources. Furthermore, the proportion of pregnant women exposed to all four message types during any of the five survey years was less than 10%.

Information from random telephone surveys of adults in the U.S. during the summer months of 1990 and 1991, and 1993 and 1994, was used to examine the impact of the alcohol beverage warning label (Greenfield, Graves, & Kaskutas, 1999). Among those who said they had consumed alcohol at some point in their life, the proportion of those who indicated they had seen the warning label in the past 12 months rose from 30% in 1990 to 43% in 1993 and 1994. The situation differed for adults in Ontario, Canada, where researchers found the percentage of those exposed to label decreased from 19% in 1991 to 12% in 1994.

Greenfield and colleagues (1999) concluded that there was evidence that adult drinkers had generally been reached by the alcoholic beverage warning label, but that awareness of its existence has stabilized. The researchers also suggested that declining conversations on the risks of prenatal alcohol consumption in the U.S. “may imply weakening interest in information that was relatively more fresh and unfamiliar earlier” (p. 277).

Universal efforts, including the alcoholic beverage warning label, did increase awareness of the risk associated with drinking alcohol during pregnancy

in the time period following its introduction, but this trend appears to have subsided (Greenfield et al., 1999; Hankin, 2002). In terms of the actual impact of these efforts on behavior – e.g., reduction or elimination of alcohol consumption during pregnancy – the impact is likely minor (Stratton et al., 1996). This may be due, at least in part, to evidence that it takes messages about the risks of prenatal alcohol consumption from multiple sources, and not just a beverage label, to alter behavior (Kaskutas & Graves, 1994), but very few pregnant women are exposed to a variety of messages (Kaskutas et al., 1998).

Or perhaps universal prevention messages that target specific groups of individuals are needed. A new two-year pilot project, with a “Play it Safe. Alcohol and Pregnancy Don’t Mix.” message is underway in Washington D.C. (American Public Health Association, 2002). This campaign, which will include radio, television, transit, magazine, newspaper, and movie theater advertisements, seeks to educate young black women and their families and friends on the risks of prenatal alcohol consumption. The results of this campaign are eagerly awaited.

Selective Prevention Strategies

Selective prevention efforts generally target women of childbearing age. Two recent studies fit this criterion. In a pilot study conducted at an obstetrics clinic, 42 pregnant women who screened positive for past month alcohol consumption were randomly assigned to receive either written information on the

dangers of prenatal alcohol consumption or a one-hour motivational interviewing session that focused on the risks of drinking alcohol during pregnancy (Handmaker, Miller, & Manicke, 1999). Women in both groups demonstrated a significant decrease in alcohol consumption, but those in the motivational interviewing group showed larger decreases in blood alcohol concentration levels. Based on outcome data, the authors concluded that simple assessment and advice may represent a sufficient intervention technique for pregnant women with relatively low levels of alcohol consumption, but that heavier drinking women may benefit from motivational interviewing.

Manwell, Fleming, Mundt, Stauffacher, and Barry (2000) reported outcome data on 205 women of childbearing age (18– 40 years), who were part of a larger brief intervention trial for early alcohol treatment. Study participants randomly assigned to the experimental group received two, 15-minute physician-delivered counseling visits, including advice and education on the risks of alcohol use. The women who received the brief intervention significantly reduced both binge drinking and seven-day alcohol use compared to women in the control group.

Data on the 41 women who became pregnant over the course of the follow-up period also provide evidence supporting the efficacy of the brief intervention (Manwell et al., 2000). The average number of drinks per week of women in the experimental group (n=22) decreased from 13.6 to 3.5 compared to a decrease from 13.5 to 10.1 drinks per week among women in the control

group (n = 19). Women who received the brief intervention and became pregnant also reduced the number of binge drinking episodes per month from 5.7 to 1.5 compared to pregnant women in the control group whose binge drinking episodes decreased from 5.5 to 4.2 per month. The differences between groups were significant.

Results of brief intervention trials (Handmaker et al., 1999; Manwell et al., 2000), which are considered selective preventions, have shown their potential in reducing alcohol consumption among pregnant women (Handmaker & Wilbourne, 2001). However, given the limited number of such trials at this time, findings should be considered tentative.

Indicated Prevention Strategies

Indicated prevention efforts target the highest risk women, including women known to be heavy drinkers or who have previously given birth to an alcohol-affected child. One such study documented the results of intensive counseling provided to 85 pregnant problem drinkers in Finland (Halmesmäki, 1988). In addition to being encouraged to abstain or reduce their alcohol consumption as much as possible, women were also counseled by a physician about the risks of alcohol to unborn babies every 2-4 weeks throughout the course of their pregnancies by a physician.

Almost two-thirds (65%) of the women were able to reduce their level of consumption by at least 50%, but 20 infants (25%) were born with a diagnosis of

FAS and 22 (26%) had some features of fetal alcohol effects (Halmesmäki, 1988). Women who were unable to reduce their drinking were more likely to have an alcohol-affected infant (89%) compared to those women who were able to reduce their drinking (40%). Among women who entered prenatal care early (between 12 and 20 weeks), and thus entered the study early, 94% were able to decrease their alcohol consumption by at least 50%, compared to only 54% of women who entered later (between 20 and 32 weeks); none of the women who entered after 32 weeks were able to make such reductions in drinking levels. The author concluded that with intensive counseling, two out of three pregnant alcohol abusers were able to significantly reduce their alcohol consumption, thereby reducing the risk of giving birth to an alcohol-affected infant from 89% to 40%.

Protecting the Next Pregnancy, a study conducted in Detroit, was designed to reduce alcohol consumption in a group of 300 women known to have consumed alcohol at risk levels during their most recent pregnancy (Hankin & Sokol, 1995). The women were recruited from a postpartum unit in Detroit, randomly assigned to a control group or to receive an intensive, brief intervention that included setting goals to abstain or reduce consumption, as well as ways in which to achieve those goals. The women were followed for five years; women in the experimental group received the brief intervention each trimester of subsequent pregnancies during that time period.

At the end of the study, women in the experimental group had lower rates of risk drinking than women in the control group (Hankin & Sokol, 1995). Results indicated that women who received the brief, intensive intervention(s) drank significantly less than controls during subsequent pregnancies, with 25% of controls drinking at least 4 drinks a day, compared to 12% of women in the experimental group. This decrease in prenatal alcohol consumption led to better birth outcomes for women in the experimental group, including fewer premature deliveries and low-birthweight infants. Furthermore, there was evidence that children of women who received the brief intervention(s) displayed better neurobehavioral performance at 13 months than did those born to women in the control group.

Astley, Bailey, Talbot, and Clarren (2000) describe a FAS primary prevention program being planned in Washington state, which targets women who have previously given birth to a child diagnosed with FAS. Through a FAS clinic, the authors have demonstrated that the majority of birth mothers of these children could be located, despite that fact that 80% of the children attending the clinic were no longer in the custody of their biological mothers. Furthermore, once located, 87% of these women agreed to participate in a study designed to generate a lifetime profile of this high-risk population. This group of researchers is currently working with Washington state officials to develop primary prevention and intervention services for this group of women.

Studies of indicated prevention efforts are also scarce, but provide some valuable information. As Halmesmäki (1988) indicates, early intervention is key in reducing women's drinking levels, and therefore decreasing the probability of giving birth to an alcohol-affected infant. The Protecting the Next Pregnancy Project (Hankin & Sokol, 1995) demonstrated that repeated messages over time could be effective in altering consumption patterns in subsequent pregnancies and improve infant health outcomes, even among a group of women known to drink at risk levels during prior pregnancies.

Despite such prevention efforts, a substantial number of women continue to consume alcohol during pregnancy. What is known about them?

Review of Risk Factor Studies

A number of studies have looked at risk factors associated with prenatal alcohol consumption. Since the interest here is specifically on alcohol consumption by pregnant women, studies on substance abuse during pregnancy that did not separate out the characteristics associated with prenatal alcohol consumption, and those that focused on the use of drugs other than alcohol during pregnancy are not included in this review. Furthermore, since this research will focus on the predominant ethnic groups in the U.S. (e.g. White, African-American/Black, Hispanic), only studies of such populations are included here. The following is a chronological review of studies that have identified risk factors of women who drink while pregnant.

In the mid to late 1980s, Zuckerman, Amaro, Bauchner, and Cabral studied depression in pregnancy by interviewing over 1,000 pregnant women at a prenatal clinic in Boston (1989). The sample consisted of predominantly minority, single, low-income women. The researchers found depression to be significantly ($p < .001$) associated with alcohol consumption.

Using data from the 1988 National Maternal and Infant Health Survey of women from 48 states and the District of Columbia, Hanna, Faden, and Dufour (1994) investigated the relationship between depression and attitude toward pregnancy and alcohol consumption during pregnancy. After examining changes in drinking behaviors before and after women learned of their pregnancy, the authors found that women who were depressed or had negative attitudes toward the pregnancy were significantly more likely to drink alcohol after learning of pregnancy ($p < .0001$). A significant ($p < .0001$) association was also found between occupation (sales) and prenatal alcohol consumption. White women were also more likely to drink than Black (OR = 0.02; 95% CI = 0.004, 0.09) and Asian women (OR = 0.02, 95% CI = 0.02, 0.15).

Upon examination of interaction effects, Black women who were classified as depressed drank significantly more ($F = 10.46$. $p < .03$) than both non-depressed Black women and White women who were depressed (Hanna et al., 1994). Furthermore, women who were depressed and separated drank significantly more ($F = 2.85$, $p<.05$) than married, depressed women, as well as

separated women who were not as depressed. Finally, depressed women working in technical positions or in private households drank significantly more ($F = 1.99$, $p < .0.05$) than women in these jobs who were not depressed, as well as non-depressed unemployed women.

Data from the National Pregnancy and Health Survey, collected from women who delivered an infant in 52 urban and rural hospitals during 1992, which provided the first national estimates of prenatal alcohol use, also provided some information on background characteristics of these women (National Institute on Drug Abuse [NIDA], 1995). Of the 2,613 women from whom self-report data were collected, White women had the highest rates of alcohol use (22.7%), followed by Black women (15.8%), and Hispanic women (8.7%). There was also strong link between prenatal alcohol use, cigarette smoking, and illicit drug use among this population.

Testa and Leonard (1995) studied 159 pregnant women recruited through newspaper advertisements and public prenatal care clinics in order to examine the influence of social networks on drinking during pregnancy. Women classified as heavy pre-pregnancy drinkers who failed to reduce their consumption were more likely to be mulitparae ($F = 5.11$, $p < .03$), ethnic minority ($F = 10.71$, $p < .01$), and of low socioeconomic status ($F = 4.69$, $p < 05$). The researchers found that women who did not abstain from alcohol use during pregnancy were likely to be members of social networks in which alcohol is commonly consumed and to

have social networks that approved of drinking during pregnancy.

Using this same sample of 159 women, Testa and Reifman (1996) examined perceived riskiness of prenatal alcohol consumption and found that women who had previously given birth to a healthy child and those with a history of alcohol problems had lower perceived risk. Using structural equation modeling, the authors found that prior healthy pregnancy outcomes (-.248) and previous alcohol problems (-.191) were both significantly ($p < .05$) negatively related to perceived risk, which in turn was inversely related to with prenatal alcohol consumption (-.395, $p < .05$). Prior alcohol problems also had a direct, positive relationship (.406, $p < .05$) with prenatal alcohol consumption, while socioeconomic status had direct, negative relationship (-.222, $p < .05$) with prenatal alcohol consumption.

Hankin et al. (1996) studied over 17,000 Black women at a prenatal clinic and identified parity as an important characteristic of women who drink during pregnancy (1996). Specifically, multiparae women, defined as those with at least one previous live birth, reported alcohol consumption at three times the rate of nulliparous women, defined as those with no previous live births ($t = 11.61$, $p < .001$).

Gladstone and Levy (1997) described the characteristics of pregnant women in Canada who reported binge drinking (5 or more drinks on one occasion) during pregnancy. Although conducted in Canada, it is included here

because of the similarity in demographics between the U.S. and Canada (Greenfield, Graves, & Kaskutas, 1999). In this study, the authors reviewed records of women who had sought counseling, either in person or by telephone, from an agency that provides information on the risks of fetal and infant exposure to teratogens during pregnancy and lactation over a period of several years. The records of all pregnant women (n = 272) who reported binge drinking, defined as 5 or more standard drinks per occasion served as the experimental group. The control group (n = 272) consisted of pregnant women who received counseling just prior to those women served as the control group, but who did not report binge drinking.

Compared to women in the control group, women who reported binge drinking were significantly younger (mean age 27.9 vs. 30.0, p <. 0001), significantly more likely to be single (12.2% vs. 54.6%, p <. 0001), and white (69.2% vs. 92.9%, p <. 004). The binge-drinking group had a higher proportion of students (11.9%) than the control group (5.3%). There were no significant differences in socioeconomic status of women, or their male partners, in the two groups.

Women who reported binge drinking were significantly (p < .0001) more likely to smoke cigarettes (57.1%) than controls (19.3%), and to use marijuana (19.3% vs. 3.0%, p < .0001) and other illicit drugs (9.2% vs. 0.7%, p < .0001).

There were no differences between groups in gravidity or parity, but women in the binge-drinking group had a significantly higher rate of prior therapeutic abortions (0.34 vs. 0.19 per woman, $p < .009$).

Noble and colleagues (1997) reported findings from an epidemiological study of alcohol and drug use among pregnant women in California. In this study, urine samples of almost 30,000 pregnant women admitted to a hospital for delivery from March through October 1992 were tested for alcohol and other drugs through blind urine toxicology screens. The results were matched to demographic data and analyzed in terms of ethnicity, acculturation, socioeconomic status, and prenatal care.

The authors reported that the alcohol use rate of 6.72% was higher than the percentage found in any other similar study (Noble et al., 1997). The alcohol use rate among African-American women (11.58%) was significantly higher than other ethnic groups. Hispanic women had the second highest rate at 6.87%, followed by non-Hispanic White women at 6.05%, and Asian and Pacific Islander women at 5.07%. However, the authors note that based on ethnic makeup of births in California, non-Hispanic White women and Hispanic women are giving birth to the highest total numbers of infants exposed to alcohol.

Noble et al. (1997) used the women's primary source of payment for medical care as an indicator of socioeconomic status. Alcohol rates were slightly higher for women on public assistance (7.27%) than for women whose medical

care was self-paid or through insurance (6.04%), with women in the latter group accounting for almost 40% of all alcohol positive screens. The authors did not indicate if these differences were statistically significant.

Noble and colleagues (1997) also examined the association between alcohol use and two acculturation variables – primary language and nativity. The rates of alcohol positive screens were similar among women whose primary language was English (6.98) and those whose primary language was not English (6.26). The alcohol-positive rates of Hispanic (7.29) and Asian/Pacific Islander (5.33) women born in the U.S. were higher than Hispanic (6.73) and Asian/Pacific Islander (4.90) women born elsewhere. However, the statistical significance of differences in acculturation variables was not noted.

In terms of prenatal care, women who received no prenatal care had higher rates of use of all substances (Noble et al., 1997). Although not as pronounced as some other drugs, women with alcohol-positive screens had higher rates of no prenatal care (8.15%) than those that did receive prenatal care (6.68%). However, any statistical significance of these differences was not indicated.

Zambrana and Scrimshaw (1997) studied psychosocial factors associated with substance use during pregnancy among Mexican-origin and African American low-income women. The sample included 525 Mexican Americans and 764 recent Mexican immigrants and 255 Black women. All were at least 20

weeks pregnant (but with no prior pregnancies beyond 16 weeks) and had no more than a high school education. Mexican American women who drank during pregnancy had significantly ($p \leq .01$) higher anxiety scores than those who did not drink, and Mexican immigrant women who drank while pregnant had significantly ($p \leq .01$) more stressful life events than those who did not drink. There were no significant differences among Black women on anxiety or life events scores. Furthermore, support of family or friends did not differentiate women who consumed alcohol while pregnant and those who did not.

Hellerstedt, Pirie, Lando, Curry, McBride, Grothaus, and Nelson (1998) used a telephone survey to examine differences in behaviors, including alcohol consumption, between women whose pregnancies were intended and those that were not. The sample consisted of 7,174 women from the states of Washington and Minnesota who had sought prenatal care early in pregnancy (mean gestation of 8 weeks) and were largely middle-income. The authors reported no difference in prenatal alcohol use by pregnancy intention.

As part of an ongoing FAS primary prevention study in Washington state, Astley, Bailey, Talbot and Clarren (2000) presented a lifetime profile of birth mothers of children with FAS, based on a sample of 80 women who had given birth to at least one child with a diagnosis of FAS or static encephalopathy with confirmed prenatal alcohol exposure. Although the author acknowledges that the women in this sample do not represent pregnant women in general, they

certainly represent some of those most at-risk for heavy prenatal alcohol consumption. Therefore, the findings are important.

Fifty-one (64%) of the women in the Astley et al. (2000) study were Caucasian, 24% Native American (this group was oversampled), 10% African American and 3% Hispanic. Although more than 60% of these women had less than a high school education, 25% had at least some college, with the mean highest level of educational attainment of these women being 10.8 years. Very few of the women (5%) had household incomes above $30,000, with incomes of 17.5% falling between $10.000 and $29,999. The remaining 77.5% reported household incomes less than $10,000, with public assistance, unemployment compensation or social security as the primary source of income for 58% of the women at the time.

Psychosocial problems are clearly present among these women (Astley et al., 2000). Almost all of the women (98%) had at least one mental health disorder, the most common of which was post-traumatic stress disorder (77.2%), followed by depression (60%). The mean number of mental health problems reported by the women in this study was 4.7 (SD 2.5), and 86.5% indicated onset of a mental health problem before they were 18 years old. In addition, 95% reported sexual and/or physical abuse at some time in their life, and 79% reported having a parent with a history of alcohol problems. The women in this study tended to start drinking at an early age (mean 15.1 years).

On average, the FAS child was the third pregnancy (mean parity 3.3, SD 1.9) of the women, with 77.2% of the pregnancies unplanned (Astley et al., 2000). Forty percent (40%) of the women reported using illicit drugs and 84% reported smoking cigarettes at the time the FAS child was born. Most of the women (80%) reported that at least one of their birth children had been in Child Protective Services care or foster care.

Astley and colleagues (2000) also obtained information from these women about personal circumstances and services utilized at the time of birth of their FAS child. On average, women were 27 years of age when the FAS child was born. More than half of the women were married or living with their partner (62.5%), but 21.2% were single or never married, and 16.3% were separated or divorced at that time. A substantial proportion of the women (40%) did not have stable, permanent housing at the time the FAS child was born, and many were receiving several forms of public assistance, including Medicaid/medical assistance (70%), the Women's, Infants, and Children's (WIC) program (67%), the former Aid to Families with Dependent Children (AFDC) program (65%), and food stamps (63%).

At the time of the interviews for this study, 50 of the women had achieved abstinence. Compared to those who had not, these women had "significantly higher IQs, higher household incomes, larger more satisfactory social support networks, and were more likely to report a religious affiliation" (Astley et al., 2000,

p. 513). Furthermore, the women who had achieved abstinence were more likely to have obtained mental health treatment.

Finally, information from the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing, state-based, random survey of the adult population, provides some of the most recent data on women who consume alcohol during pregnancy (CDC, 2002). The latest BRFSS report, which summarizes information from 1995, 1997, and 1999, includes data from pregnant women in all 50 states regarding their alcohol consumption in the last 30 days.

Pregnant women who reported recent alcohol use were more likely to be older (31-44 years vs. 18 – 30 years), unmarried, employed, nonwhite, and have at least a high school education. Frequent and binge drinking were more common among older (30-44 years) pregnant women than those less than 30 years.

The table below provides a summary of the above studies by risk factors.

Table 2-1

"Risk Factors Associated with Prenatal Alcohol Use"

Factor	**Studies**
Age 25+	Gladstone & Levy, 1997 Astley et al., 2000 CDC, 2000
Ethnicity	
White	Hanna et al., 1994 NIDA, 1995* Gladstone & Levy, 1997
Black	Testa & Leonard, 1995 Noble et al., 1997

Table 2-1 continued

Low socioeconomic status	Testa & Leonard, 1995 Testa & Reifman, 1996 Noble et al., 1997* Astley, et al., 2000*
Education, < high school	Astley et al., 2000*
Employed	CDC, 2000
Marital status	
Single	Hanna et al., 1994 Gladstone & Levy, 1997 CDC, 2000
Married	Astley et al., 2000*
Depression	Zuckerman et al., 1989 Hanna et al., 1994
Anxiety	Zambrana & Scrimshaw, 1997
History of physical or sexual abuse	Astley et al., 2000*
Negative attitude toward pregnancy	Hanna et al., 1994
Lack of prenatal care	Noble et al., 1997*
Cigarette smoking	NIDA, 1995* Gladstone & Levy, 1997 Astley et al., 2000*
Illicit drug use	NIDA, 1995* Gladstone & Levy, 1997
Social network supportive of drinking	Testa & Leonard, 1995
Multiparity	Testa & Leonard, 1995 Hankin et al., 1996
Prior healthy pregnancy outcomes	Testa & Reifman, 1996
Prior abortions	Gladstone & Levy, 1997
Unplanned pregnancy	Astley et al., 2000*
Unstable housing	Astley et al., 2000*
Involved with CPS, foster care system	Astley et al., 2000*
Alcohol problems	
Personal	Testa & Reifman, 1996 Astley et al., 2000*
Parental	Astley et al., 2000*

*denotes a finding of increased incidence, but significance data not reported.

Summary of Risk Factors

This review yielded valuable information regarding the nature of prenatal

alcohol consumption and highlighted several gaps in knowledge. First, a perusal of Table 2-1 shows that prenatal alcohol consumption is a behavior clearly influenced by multiple factors that are not only individual attributes, but also social and environmental. Individual risk factors include age, marital status, parity, mental health problems, level of education, and other behaviors, while social and environmental risk factors include ethnicity, socioeconomic status, employment status, and characteristics of social networks. However, caution must be used before drawing any conclusions from this review about patterns of risk factors because most research on this population has utilized rather limited research designs with “samples of low-income women, women in drug treatment centers, women of color, and patients at inner-city public hospitals” (Finch, Vega, & Kolody, 2001, p. 572), thereby limiting the generalizability of findings to other populations.

In addition to highlighting the range of risk factors that may help predict prenatal alcohol consumption, this review raises the question about whether risk factors may vary by ethnicity. For instance, Zambrana and Scrimshaw (1997) found that anxiety was significantly associated with prenatal alcohol consumption among Mexican American women, but not among Black women (White women were not included in this study). However, the remainder of the studies reviewed simply examined risk factors in the overall sample, rather than investigating differences by ethnicity. This is a major gap in the literature.

Another gap relates to the theoretical underpinnings, or really lack thereof, offered by studies of prenatal alcohol consumption. Despite the complex nature of prenatal alcohol consumption and a need for a more comprehensive understanding of the factors that influence this behavior, no study placed risk factors within any sort of theoretical framework.

One final limitation in the literature on prenatal alcohol consumption must be underscored. Although some studies provided descriptive data that can be utilized as a basis for beginning to explore possible protective factors, such as Astley and colleagues (2000) who noted some differences between women who had managed to achieve abstinence and those who had not, none of the studies specifically aimed to investigate factors that might act in a protective capacity in this population. There is a vital need to understand not only those factors that seem to encourage prenatal alcohol consumption, but also those facts that discourage this behavior (Stratton et al., 1996).

Conclusion

This review of risk factors will be incorporated into the conceptual model, described in Chapter 3 that will be tested using data from the National Survey on Drug Use and Health. These findings will serve as a basis for recommendations about prevention strategies, practice issues, and future research.

Chapter 3

Conceptual Framework:

A Risk-Protective Model of Prenatal Alcohol Consumption

Existing Theoretical Frameworks and Gaps in the Literature

Understanding complex human behavior is a major goal of any social scientific inquiry and a primary route for achieving this goal is through the use of theory to guide explanations. A search of the literature for theories or conceptual models that have served to clarify those factors which influence prenatal alcohol consumption resulted in the discovery of only one model.

According to Lindenberg, Reiskin, and Gendrop (1994), the Social Stress Model of Substance Abuse proposes that substance use is the result of an individual's stress level "and the extent to which it is mitigated by factors such as social networks, social competencies, and resources" (p. 254). At the time of Lindenberg and colleagues' article, this model had been applied to women of childbearing age in a number of articles, but had yet to be tested with them. Nothing more recent suggests this has changed. Although this model recognizes the influence of social factors on behavior, it does not acknowledge the role that other factors, such as individual attributes, may play in prenatal alcohol consumption.

Other than the Social Stress Model, the search for frameworks that promote a better understanding of prenatal alcohol consumption revealed little,

illustrating a dearth of viable paradigms. This omission is a major shortcoming in the literature, since prenatal alcohol consumption is now believed to result from the complex interplay of numerous factors (Stratton, Howe, & Battaglia, 1996). Yet, most studies on women who consume alcohol during pregnancy have examined only a limited number and range of factors (Stratton et al., 1996) and have failed to even place, much less test, factors that influence this behavior within any sort of theoretical framework. Furthermore, the vast majority of studies have examined only risk factors of women who drink during pregnancy, virtually ignoring the investigation and identification of protective factors that could decrease prenatal alcohol consumption (Stratton et al., 1996). Study of protective factors is now one of the key recommendations of the Institute on Medicine's (IOM) Committee to Study Fetal Alcohol Syndrome.

Appropriateness of Resilience Models to Prenatal Alcohol Use

Given the need to examine protective factors, in addition to risk factors, associated with prenatal alcohol consumption, resilience models seem especially well suited for this endeavor. Greene (2002) suggests that resilience models are particularly appropriate for social workers in their attempt to understand complex human behavior, since resilience frameworks focus on client strengths, acknowledge the importance of the person-in-environment, and are applicable across the life span with a variety of issues.

Although resilience models are generally thought of in relation to children

and adolescents, the frameworks have also been extensively applied to adult populations (Greene, 2002), and experts have noted the appropriateness of applying risk-protective models to the study of prenatal alcohol consumption.

Stratton and colleagues (1996) used a resilience framework to depict those biological and environmental factors that appear to influence whether alcohol consumption during pregnancy results in FAS or other alcohol-related effects. Rondero (2000) suggested that a risk-protective framework be utilized to develop intervention strategies for children affected by FAS. Adopting a prevention approach to prenatal alcohol consumption, a resilience framework can be used for identifying and intervening with women at risk for delivering an alcohol-affected child.

Background of Resilience Models

Study of risk and resilience began with an interest in developments in the public health arena (Greene, 2002) and epidemiological concerns with conditions related to morbidity and mortality (Jessor, 1992). Although traditional understandings of what constituted risk factors were originally limited to biomedical definitions, more recent understanding of complex behaviors have come to acknowledge the role that the social environment and individual behaviors have in understanding risk (Jessor, 1992). Furthermore, researchers and practitioners alike began to question why some individuals did not appear to have the same negative outcomes that others did, given quite similar unfavorable

situations (Greene, 2002; Jessor, 1992). For example, why did some, but not all, smokers develop heart disease? Or why did some adolescents growing up under severely adverse conditions manage to “make it”?

According to Greene (2002), theoretical understandings of resilience have roots largely in research on at-risk children (Bogenschnieder, 1996; Hawkins, Catalano, & Miller, 1992; Werner & Smith, 1982). Many of these undertakings involved longitudinal studies in which the researchers “examined *risk* factors – conditions that increase the likelihood that a child will develop a problem – and *protective* factors - conditions that buffer, interrupt, or prevent problems from occurring” (Greene, 2002, p. 4). The underlying, and arguably most critical, value of investigating and identifying resilient, or protective, factors in vulnerable populations is that they not only further an understanding of how people overcome adversity, they also will help inform the development of new intervention strategies that “foster client strengths, adaptation, healing, and self-efficacy” (p. 2).

Greene (2002) also points out that there is no agreed upon definition of either risk or resilience, and both remain broadly defined. Furthermore, resilience has been “used interchangeably with *positive coping, adaptation,* and *persistence*” among other terms (Winfield, 1994 in Greene, 2002, p. 29). For the purposes of this study, risk factors will be defined as “variables associated with a high probability of onset, greater severity, and longer duration of major mental

health problems" (Coie et al., 1993, p. 1013). Protective factors will be defined as "conditions that improve people's resistance to risk factors and disorder" (Coie et al., 1993, p. 1013).

Identifying Risk Factors of Prenatal Alcohol Consumption

Developing a resilience model requires identification of both potential risk and protective factors. Table 3-1 summarizes the potential risk factors identified in Chapter 2.

Table 3-1
"Risk Factors Associated with Prenatal Alcohol Use"

Factor	**Studies**
Age 25+	Gladstone & Levy, 1997 Astley et al., 2000 CDC, 2000
Ethnicity	
White	Hanna et al., 1994 NIDA, 1995* Gladstone & Levy, 1997
Black	Testa & Leonard, 1995 Noble et al., 1997
Low socioeconomic status	Testa & Leonard, 1995 Testa & Reifman, 1996 Noble et al., 1997* Astley, et al., 2000*
Education, < high school	Astley et al., 2000*
Employed	CDC, 2000
Marital status	
Single	Hanna et al., 1994 Gladstone & Levy, 1997 CDC, 2000
Married	Astley et al., 2000*
Depression	Zuckerman et al., 1989 Hanna et al., 1994
Anxiety	Zambrana & Scrimshaw, 1997
History of physical or sexual abuse	Astley et al., 2000*

Table 3-1 continued

Negative attitude toward pregnancy	Hanna et al., 1994
Lack of prenatal care	Noble et al., 1997*
Cigarette smoking	NIDA, 1995* Gladstone & Levy, 1997 Astley et al., 2000*
Illicit drug use	NIDA, 1995* Gladstone & Levy, 1997
Social network supportive of drinking	Testa & Leonard, 1995
Multiparity	Testa & Leonard, 1995 Hankin et al., 1996
Prior healthy pregnancy outcomes	Testa & Reifman, 1996
Prior abortions	Gladstone & Levy, 1997
Unplanned pregnancy	Astley et al., 2000*
Unstable housing	Astley et al., 2000*
Involved with CPS, foster care system	Astley et al., 2000*
Alcohol problems **Personal** **Parental**	 Testa & Reifman, 1996 Astley et al., 2000* Astley et al., 2000*

*denotes a finding of increased incidence, but significance data not reported

Identifying Protective Factors of Prenatal Alcohol Consumption

Astley and colleagues (2000) developed lifetime profiles of women who had given birth to an FAS child and examined differences between the women they interviewed who had been able to achieve abstinence and those who had not. Compared to women unable to achieve abstinence, women who had achieved abstinence had significantly higher IQs, higher incomes, and more extensive social support systems. Furthermore, women who had achieved abstinence were more likely to have a religious affiliation and to have had obtained mental health treatment.

A qualitative study of factors that appeared to deter inner-city Hispanic

women (N=24) from engaging in substance abuse also provides some insight into possible protective factors (Lindenberg et al., 1994). The women, who were recruited from a public prenatal clinic, were all of childbearing age (18-34 years) and all but one had at least one child at the time of the interview. The authors analyzed information from focus groups revealing six major themes. Each could serve to prevent substance use:

1. Family antecedents– positive family role models, parental values and behaviors
2. Personal competence – self-esteem, self-assurance, self-mastery, assertiveness, good mental health, communication skills, problem-solving skills, education
3. Adult developmental roles – serving as a role model for own children, having personal and life goals, establishing enduring relationships
4. Social pressure – friends, family who do not encourage substance use
5. Stress and environmental factors – familial resources, language
6. Economic participation and resources - adequate housing, employment, income, social services and health care; spiritual resources

Risk-protective models with at-risk youth are among the most well developed and tested. Since information regarding protective factors in the literature on prenatal alcohol consumption is limited, factors protecting at-youth

were also examined. According to the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2000b), studies by Hussong and Chassin (1997), Hawkins (1997), and Resnick et al. (1997) are key studies in this area.

In a three-year study of adolescents, Hussong and Chassin (1997) examined whether five factors (self-awareness, perceived control, family organization, behavioral coping, cognitive coping) buffered children of alcoholic families from beginning to use substances. Compared to a group of matched controls, adolescents in alcoholic families were less likely to initiate substance use if they had greater perceived control in their lives or if they had extreme (either very high or low) cognitive coping skills. Furthermore, regardless of whether they belonged to an alcoholic family, adolescents with highly organized families and those with extreme (very high or low) behavior coping skills were less likely to engage in substance use.

Hawkins (1997) investigated the role family rituals and routines play in drinking patterns of children raised in alcoholic families. She found that children raised in alcoholic families were less likely to report problem drinking as young adults if their family of origin had maintained rituals and daily routines.

Resnick and colleagues (1997) reported findings from the National Longitudinal Study on Adolescent Health, which included interviews with approximately 12,000 youth grades 7 through 12 about risk behaviors in the areas of substance abuse, emotional health, violence, and sexuality. Two

protective factors held up across all four areas of risk. The first protective factor was parent-family connectedness, which included adolescents feeling close to one or both parents, feeling cared about by one or both parents, and feeling satisfied with one or both parental relationships, and feeling loved and wanted by members of their family. The second protective factor was school connectedness, which included a perception that students were treated fairly by teachers, as well as a feeling of closeness to people at school and being a part of school. Importance of religion and prayer was another significant protective factor against alcohol use.

Although these findings suggest that protective factors may be found at both the individual and the social/environmental levels, several limitations must be noted. Many of the studies reviewed are purely descriptive or based on relatively small samples (Astley et al., 2000; Lindenberg et al., 1994) or based on convenience samples (Hawkins, 1997; Hussong & Chassin, 1997). Furthermore, many of the findings that are statistically significant are based on nationally representative samples of youth (Resnick et al., 1997). Despite the limitations, these studies provide a starting point for exploring such factors and a basis for constructing a conceptual framework that lends itself to multivariate analysis. Protective factors identified in the literature are summarized in Table 3-2.

Table 3-2
"Possible Protective Factors of Prenatal Alcohol Use"

Factor	Studies
Social support	Lindenberg et al., 1993* Astley et al., 2000*
Spirituality	Lindenberg et al., 1993* Resnick et al., 1997 Astley et al., 2000*
Adequate income	Lindenberg et al., 1993* Astley et al., 2000*
Mental health treatment	Astley et al., 2000*
High self-esteem	Lindenberg et al., 1993*
Positive family relationships	Lindenberg et al., 1993* Resnick et al., 1997
Competence, coping skills	Lindenberg et al., 1993* Husson & Chassin, 1997
Organized family	Hawkins, 1997 Husson & Chassin, 1997
Access to health/social services	Astley et al., 2000* Lindenberg et al., 1993*
High IQ	Astley et al., 2000*
Good mental health	Lindenberg et al., 1993*
School connectedness	Resnick et al., 1997

*denotes a finding of increased incidence, but significance data not reported

Concept Identification

To formulate a testable model, the risk and protective factors identified in this chapter and Chapter 2 were placed into logical groupings from which the following concepts emerged.

Risk Concepts

- Ethnicity
- Age
- Marital status

- Mental health problems
- Substance use/problems: use and behaviors surrounding both legal and illicit substances
- Reproductive history: women's pregnancy history and outcomes
- Economic vulnerability: factors that are signs of, or that may contribute to the maintenance of, a lower SES, such as lower levels of income and education, public assistance receipt, and unstable housing
- Negative social influence: potentially harmful characteristics of friends, family
- Negative community influence: potentially harmful neighborhood characteristics

Protective Concepts

- Economic stability: factors that are signs of, or help contribute to the maintenance of, a higher SES, such as higher levels of income and education, stable housing and employment.
- Personal competency: an overall sense of well-being, self-efficacy
- Home environment: potentially beneficial family characteristics
- Social Support: potentially beneficial characteristics of non-familial relationships
- Spirituality: affiliation with, and importance of the practices of, a religious or spiritual faith

- Service Access: possession of means to obtain needed health and social services

A Proposed Risk-Protective Model of Prenatal Alcohol Consumption

In order to logically group the range of possible risk and protective concepts identified above, a conceptual model building upon the work of Catalano and Hawkins (1995) and Rew, Thomas, Horner, Resnick, and Beuhring (2001) was developed.

In their risk-focused prevention model for adolescent health and behaviors, Catalano and Hawkins (1995) suggest that risk and protective factors exist at multiple levels. At the community level, risk factors include the availability of drugs, community norms that endorse drug use, and mobility. At the family level, risk factors include family conflict and management problems. School risk factors include early academic failure (elementary) and lack of commitment to school. Finally, individual/peer risk factors include rebelliousness and friends who engage in problem behaviors. Drawing on the review of risk and protective factors above and adapting the levels of influence identified by Catalano and Hawkins (1995) to the population of pregnant women, the following concepts by level of influence or “domain” – e.g. individual risk, social/environmental risk, individual protective, social/environmental protective – are identified in Table 3-3:

Table 3-3
"Risk and Protective Factors by Domain"

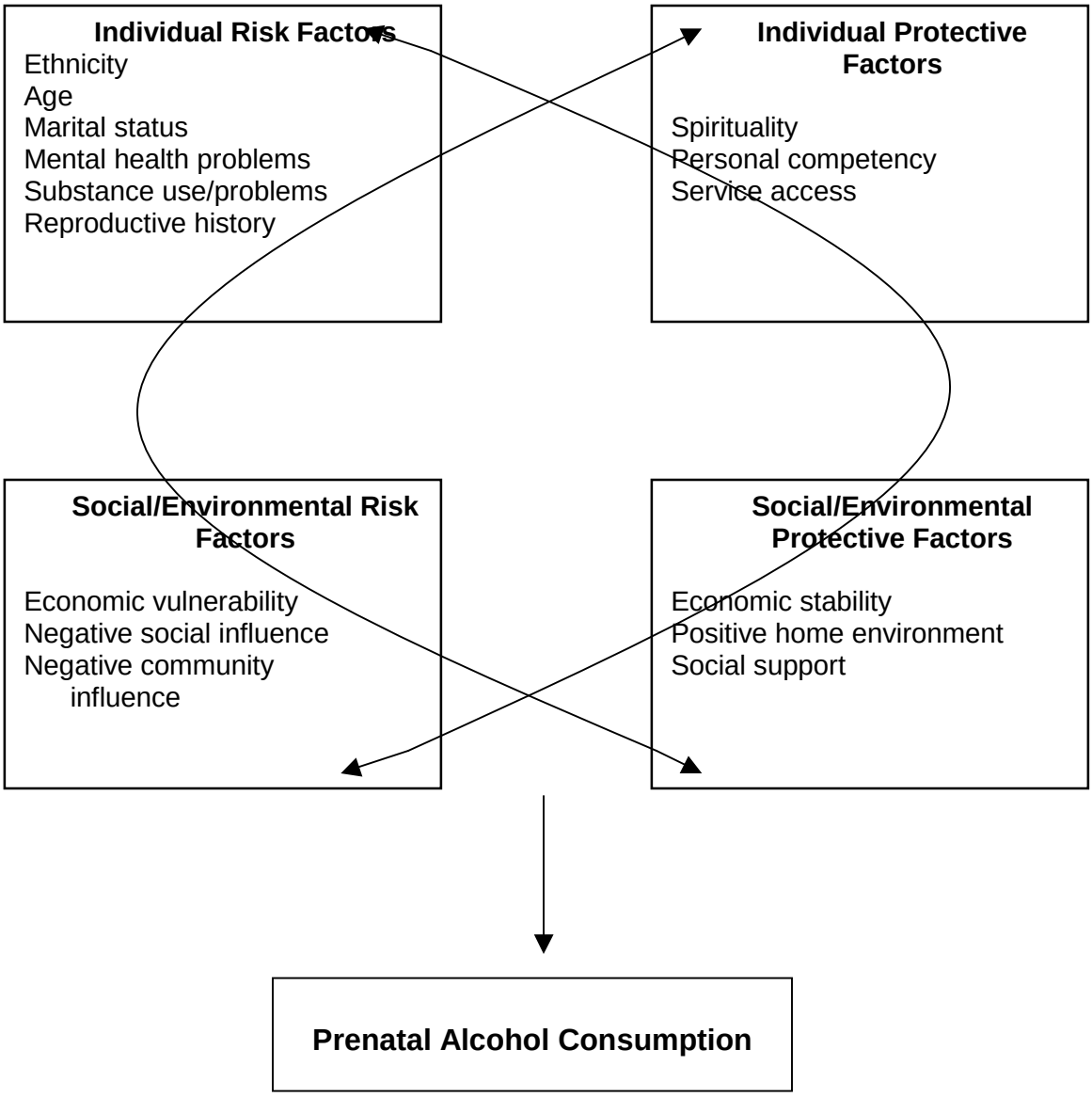
Risk Factors	Protective Factors
Individual Ethnicity Age Marital status Mental health problems Substance use/problems Reproductive history	*Individual* Spirituality Personal competency Service access
Social/Environmental Economic vulnerability Negative social influence Negative community influence	*Social/Environmental* Economic stability Positive home environment Social support

Rew and colleagues (2001) presented a risk-protective framework for examining adolescent suicide attempts. Their model is relevant to the present investigation because it both acknowledges the importance of individual and environmental, as well as risk and protective, influences on behavior and depicts the "interaction of individual risk factors (i.e., gender, stress, depression/hopelessness, risky behaviors), sociocultural contextual factors (i.e., ethnicity, family functioning, suicide by others), and protective factors (i.e., social connectedness, religious influence, and social activities)" as a means of understanding behavior as complex as adolescent suicide attempts (Rew et al., 2001, p. 362).

Drawing upon works such as Catalano and Hawkins (1995) and Rew et al. (2000), the conceptual model in Figure 3-1 was developed to illustrate that prenatal alcohol consumption is thought to be the result of a complex interplay of

risk and protective factors that exist at both the individual and social/environmental levels. This model forms the basis for the present study and methodology described in Chapter 4.

Figure 3-1
"A Risk-Protective Model of Prenatal Alcohol Consumption"



Chapter 4

Methodology

Secondary analysis of data from the National Survey on Drug Use and Health will be conducted to address the research questions posed by this study. A series of hierarchical logistic regression analyses will be completed to assess the influence of the risk and protective domains on prenatal alcohol consumption, determine the most influential variables on drinking during pregnancy, and explore any differences by ethnicity.

Overview of Research Design

Secondary data analysis of interview data from the 2001 National Survey on Drug Use and Health (NSDUH), formerly known as the National Household Survey on Drug Abuse, will be conducted for this study. In addition to descriptive analyses of the population of pregnant females, multivariate analyses using logistic regression techniques will first be conducted using data from the 2001 NSDUH. Separate analyses will then be conducted using data from the 2002 NSDUH in an effort to cross-validate results from 2001 data. Finally data from the two years (2001-2002) will be pooled in order to achieve greater power in answering the questions posed by this study. Once 2001 (n = 949) and 2002 (n = 865) data are combined, the final data set will consist of 1814 cases of pregnant females, with 212 reporting recent alcohol use.

Description of the Data Set and Sampling Methods

The Substance Abuse and Mental Health Services Administration (SAMHSA) of the U.S. Department of Health and Human Services (USDHHS) conducts the NSDUH annually. This data set was chosen because it contains items that are appropriate measures for most of the concepts in the Risk-Protective Model of Prenatal Alcohol Consumption, uses probability sampling methods, and identifies the pregnancy status of females at the time of the interview. Furthermore, because the survey is conducted annually, data from subsequent surveys can be used to validate findings from this study, to refine the proposed Risk-Protective Model, and to track changes in determinants of drinking during pregnancy over time.

The National Survey on Drug Use and Health measures the prevalence and correlates of illicit drugs, alcohol, and tobacco use in the United States among individuals aged 12 and older (USDHHS, SAMHSA, 2002, 2003). In addition to a range of questions on history and frequency of substance use, the survey includes items on mental health problems, access to health care, and income and resources. Demographic data available in the data set include ethnicity, age, marital status, educational level, and employment status. Data for the NSDUH are collected through personal interviews, and audio computer-assisted self-interviews from the general population, which include individuals residing in college dormitories, group homes, shelters, rooming houses, and

civilians dwelling on military installations.

The sampling method is multistage area probability sample for all 50 states and the District of Columbia (USDHHS, SAMHSA, 2002, 2003). States are the first level of stratification, which are then divided into Field Interviewer (FI) Regions. FI Regions are then divided into area segments, which are made up of adjacent census blocks and were the primary sampling units, from which dwelling units were chosen via systematic sampling. Similar numbers of individuals in the 12-17, 18-25, and 26 and older age groups are included in the sample. A more complete description of the data set and sampling methods is available in Appendix A.

Sample Size and Characteristics of 2001 Cohort

When this proposal was first developed, only the 2001 NSDUH data set was available. At that time, SPSS was used to conduct the following preliminary descriptive analysis of the subset of females in the 2001 survey who indicated they were pregnant at the time of interview (n = 949).

Among 2001 pregnant females, 111 (11.7%) reported alcohol use within the past 30 days. Additional characteristics of the 2001 cohort are displayed in Tables 4-1 and 4-2.

Table 4-1
"Ethnicity and Income Breakdowns of 2001Pregnant Females"

Ethnicity (n=949)	**%**	**Income (n=949)**	**%**
Non-Hispanic White	59.9	$0-$9,999	12.2
Hispanic	17.4	$10,000-$19,999	16.3
Non-Hispanic Black/African American	14.4	$20,000-$29,999	17.2
		$30,000-$39,999	15.6
Non-Hispanic Asian	3.8		
		$40,000-$49,999	12.5
Non-Hispanic Native American/ Alaskan Native	2.1	$50,000-$74,999	14.3
Non-Hispanic, more than one race	2.0	$75,000+	11.8
Non-Hispanic Native Hawaiian/Other Pacific Islander	0.4		

Table 4-2
"Age, Marital Status, and Education of 2001 Pregnant Females"

Age (n=949)	**%**	Marital Status (n = 949)	**%**	**Highest Level of Education (n = 949)**	**%**
≤ 18 years	13.8	Married	54.9	Less than 12th grade	27.4
19-23 years	37.6	Divorced/separated	3.7	12th grade	35.2
24-29 years	31.1	Widowed	0.1	Higher than 12th grade	37.4
30-34 years	13.1	Never married	41.2		
≥ 35 years	4.4	Respondent is < 14	0.8		

Pregnant females in the 2001 cohort were predominantly Non-Hispanic White and almost three-fourths had at least a high school education (72.6%).

Over half of the sample was married (54.9%), with 41.2% having never been married. Over two-thirds (68.7%) of the cohort ranged from 19-29 years of age, while total family income appeared relatively evenly distributed.

While comparisons among pregnant women of different ethnic backgrounds are desired, the small percentages in many ethnic groups indicated that collapsing of some ethnic categories would likely be necessary.

Variables in the Analysis

The NSDUH contains over 2000 variables; those that appeared to be the best to measure the concepts that lie within each of the four domains (individual risk factors, social/environmental contextual risk factors, and protective factors) of the Risk-Protective Model of Prenatal Alcohol Consumption were retained for analyses. Additional variables were retained for descriptive purposes. A list of the original NSDUH variables can be found in Appendix B.

Dependent Variable

The dependent variable (ALCMON) indicates whether the respondent consumed alcohol in the past month; it is dichotomous.

Recoded Variables

Because logistic regression techniques will be used, the following variables were dummy-coded:

- Whether the respondent is employed (EMPLYD) was recoded from EMPSTAT4, which contained four categories, into a dichotomous variable

of employed (full or part-time) or unemployed (or not in the labor force); 12-17 year olds were coded as unemployed.

- The respondent's ethnicity (ETHNIC) was recoded from NEWRACE2 with 7 categories to a dichotomous variable of White and non-White.
- The respondent's marital status (MARRIED) was recoded from IRMARIT with 5 categories to a dichotomous married or unmarried (single, divorced, never married) variable.
- The respondent's age (NEWAGE) was recoded from AGE2 with multiple categories to a dichotomous variable consisting of two groups – aged 25 years and younger and those 26 years and older to reflect findings from the literature.

New Variables

The following variables were created from original variables:

- SPIRITLY was created from adult (SNRLDCSN) and youth (YERLDCSN) versions of a variable asking if religious beliefs influenced how the respondent makes decisions. Both variables were originally ordinal and were recoded into a dichotomous variable of "agree" or "disagree".
- DRKFRDS was created from adult (SNFDDRK) and youth (YESTSDNK) versions of a variable asking how many friends got drunk every week. Both variables were originally ordinal and were recoded into a

dichotomous variable of “none or few of them” or “most or all of them”.

Variables by Domain

The following tables contain the variables and their operational definitions that were used to measure concepts within the individual risk domain(Table 4-3), the social/environmental risk domain (Table 4-4), the individual protective domain (Table 4-5), and social/environmental protective domain (Table 4-6). Lack of appropriate variables precluded measurement of the concepts of “reproductive history,” “personal competency,” and “positive home environment”.

Table 4-3
“Individual Risk Variables”

Concept	**Variable Name**	**Operational definition**
Ethnicity	NEWRACE or ETHNIC**	Respondent’s ethnic background
Age	NEWAGE**	Respondent’s age
Marital status	MARRIED**	Respondent’s marital status
Mental health problems	ADMHTX	Mental health treatment in the past year
Substance use/problems	ABODALC CIGMON SUMMON	Alcohol abuse or dependence in the past year Cigarette smoking in the past month Illicit drug use in the past month

*indicates a newly created variable
**indicates a recoded variable

Table 4-4
"Social/Environmental Risk Variables"

Concept	**Variable Name**	**Operational Definition**
Economic vulnerability	GOVTPROG	Participation in at least one government assistance program
Negative social influence	DRKFRDS*	Number of friends who get drunk at least once a week
Negative community influence	APPSELDG	Approached by someone selling illegal drugs in the past month

*indicates a newly created variable
**indicates a recoded variable

Table 4-5
"Individual Protective Variables"

Concept	**Variable Name**	**Operational Definition**
Spirituality	SPIRTLY*	Religious beliefs influence decisions
Service Access	ANYHLTIN	Does respondent have health insurance

*indicates a newly created variable
**indicates a recoded variable

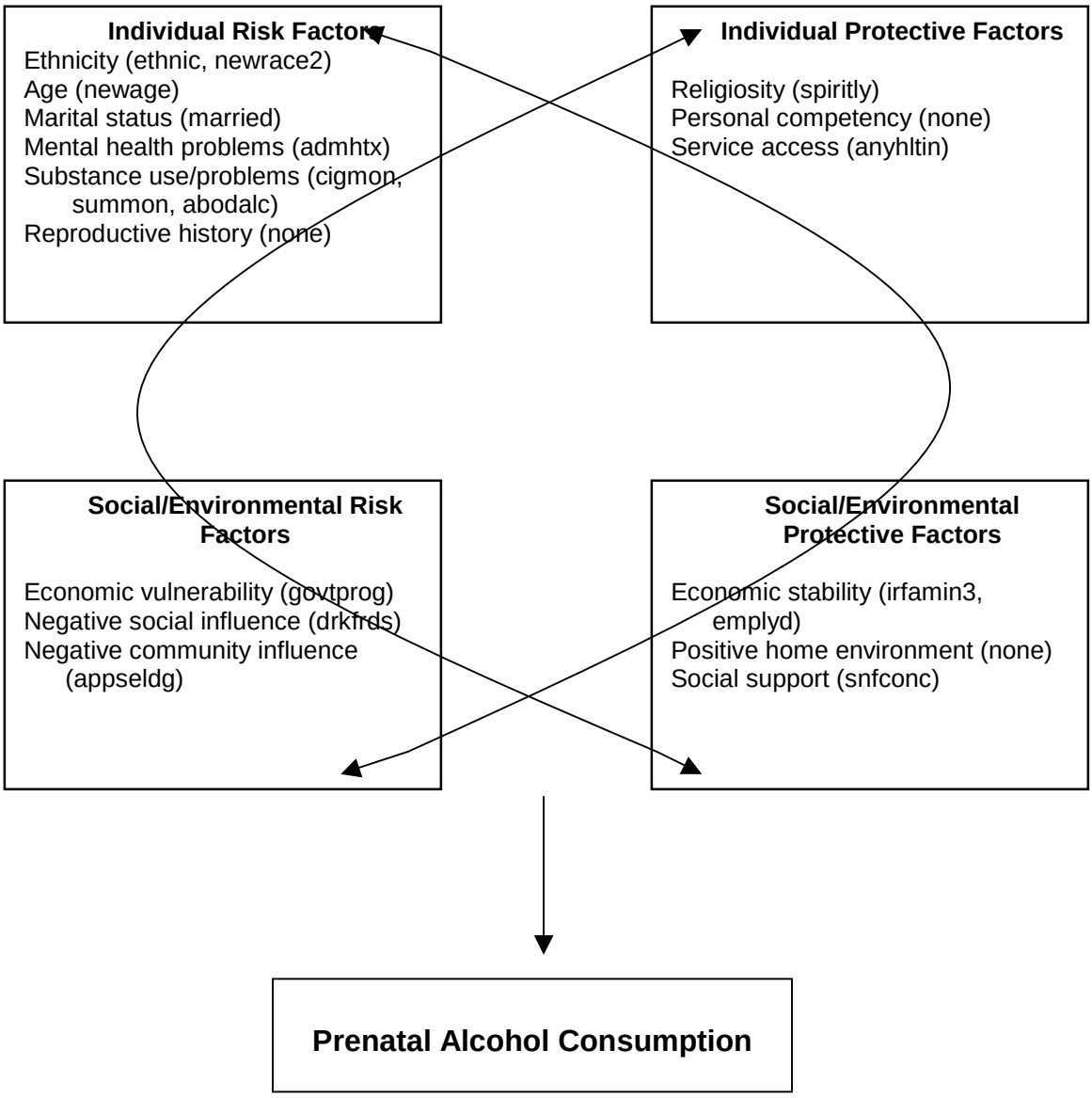
Table 4-6
"Social/Environmental Protective Variables"

Concept	**Variable Name**	*Operational Definition*
Economic stability	IRFAMIN3 EMPLYD**	Total family income Employment status
Social support	SNFCONC	Number of friends with whom share concerns

*indicates a newly created variable
**indicates a recoded variable

Figure 4-1 shows the variables used to measure each of the concepts within the Risk Protective Model of Prenatal Alcohol Consumption.

Figure 4-1
"A Risk-Protective Model of Prenatal Alcohol Consumption:
Concept Measurement Variables"



Missing Data Analysis and Sample Size Issues

Any case or variable with 50% or more of its data missing should be

automatically considered for exclusion (Schwab, 2002). The distribution of missing data from the variables in the Risk-Protective Model can be seen in Tables 4-7 and 4-8 below. The variables with the largest amount of missing data were the measure of whether a respondent had received mental health treatment in the past year (ADMHTX) and the number of friends with whom the respondent shares personal issues and concerns (SNFCONC). In the pooled data set, 8.4% of the data was missing from ADMHTX and 8.5% from SNFCONC. Given that these two questions were only asked of adult respondents (and without an equivalent measure for youth), this missing data is not surprising.

Missing data among pregnant women reporting recent alcohol use followed a similar pattern, with the same variables missing the most data. ADMHTX was missing 17 responses (8.0%)and SNFCONC was missing 18 responses (8.5%). Since these variables (ADMHTX and SNFCONC) appeared to be the best measures available for the particular concepts and the amount of data missing from both variables was less than 10%, they were both retained for analysis.

Table 4-7
"Missing Data by Variable:
All Pregnant Females"

Variable	2001 NSDUH (n=949)	2002 NSDUH (n=865)	2001/2002 NSDUH (n=1814)
ALCMON	0	0	0
ETHNIC	0	0	0
MARRIED	0	0	0
NEWAGE	0	0	0
ADMHTX	83	69	152
ABODALC	0	0	0
CIGMON	0	0	0
SUMMON	0	0	0
SPIRTLY	21	7	28
ANYHLTIN	8	2	10
GOVTPROG	0	0	0
DRKFRDS	34	22	56
APPSELDG	2	1	3
IRFAMIN3	0	0	0
EMPLYD	0	0	0
SNFCONC	87	68	155

Table 4-8
"Missing Data by Variable
Pregnant Females Reporting Recent Alcohol Use"

Variable	2001 NSDUH (n=111)	2002 NSDUH (n=101)	2001/2002 NSDUH (n=212)
ALCMON	0	0	0
ETHNIC	0	0	0
MARRIED	0	0	0
NEWAGE	0	0	0
ADMHTX	7	10	17
ABODALC	0	0	0
CIGMON	0	0	0
SUMMON	0	0	0
SPIRTLY	4	0	4
ANYHLTIN	2	0	2
GOVTPROG	0	0	0
DRKFRDS	2	2	4
APPSELDG	0	0	0
IRFAMIN3	0	0	0
EMPLYD	0	0	0
SNFCONC	8	10	18

Table 4-9 displays missing data by cases. Almost 90% of the cases had no missing data and no cases were missing over 4 responses. No cases met criteria for exclusion from analysis.

Table 4-9
"Missing Variables by Case"

#of missing variables	2001 Frequency	2001 %	2002 Frequency	2001 %	2001/2002 Frequency	2001/ 2001 %
0	826	87.0	782	90.4	1608	88.6
1	35	3.7	13	1.5	48	2.6
2	64	6.7	55	6.4	119	6.6
3	24	2.5	14	1.6	38	2.1
4	0	0.0	1	0.1	1	0.1

Avoiding Numerical Problems

No zero cells for dummy coded independent variables were seen. Furthermore, problems with multicollinearity were not anticipated, as no strong correlations were found between any of the predictors. Using the 2001 data, the largest correlation (R = .39) was seen between IRFAMIN3 (income) and GOVTPROG (participation in one or more government assistance programs); the next highest correlation (r= .36) between MARRIED (marital status) and NEWAGE (age). Although numerical problems were not anticipated, regression models will be examined for standard error scores > 2.

Descriptive Analyses

In addition to preliminary findings just presented, descriptive analysis of all three cohorts of pregnant females (e.g. 2001, 2001, 2001/2002) will be conducted on trimester of pregnancy, employment status, alcohol/other substance use, mental health problems, support of family/friends, spirituality, and health insurance coverage. In addition, bivariate comparisons of pregnant females reporting recent alcohol use and those who did not will also be conducted on these variables in order to further describe the population, as well as identify other possible predictors.

Multivariate Analyses: Logistic Regression

In order to answer the primary questions posed by this study and test the Risk-Protective Model of Prenatal Alcohol Consumption, logistic regression (LR) was selected as the analytic method for the following reasons:

- LR is an appropriate multivariate technique for use with a dichotomous dependent variable, which in the current study is ALCMON, a variable indicating whether or not the respondent has consumed any alcohol in the past month;
- LR allows the inclusion of both continuous and dichotomous independent variables, both of which are included in the conceptual model (original NSDUH variables were recoded into dichotomous variables where necessary as already indicated);

- LR allows predictors to be entered in “blocks,” thereby providing information on the contribution that each block makes towards explaining the variance in the dependent variable. The blocks in this analysis are the four major domains of the conceptual model (e.g. individual risk, social/environmental risk, individual protective, social/environmental protective);
- LR lends itself to interpretation in terms of “odds ratios” that most people can comprehend; and finally,
- LR is not affected by violations of the assumption of normality, linearity, or equality of the variance, making it a more attractive option than the alternative method of discriminant analysis.

Multivariate Analysis Strategy – 2001 NSDUH

Study Question #1

In order to address the question regarding the relative contribution of each of major domains, predictors will be entered in the following manner:

- Block 1: Individual risk factors (ETHNIC, MARRIED, NEWAGE, ADMHTX, ABODALC, CIGMON, SUMM0N)
- Block 2: Individual protective factors (SPIRTLY, ANYHLTIN)
- Block 3: Social/environmental risk factors (GOVTPROG, DRKFRDS, APPSELDG)
- Block 4: Social/environmental protective factors (IRFAMIN3, EMPLYD,

SNFCONC)

This method of entry was chosen because it seemed most illustrative of the Risk-Protective Model of Prenatal Alcohol Consumption and reflected what other researchers have written regarding risk-protective models – that behaviors such as alcohol consumption during pregnancy result from a complex interplay of risk and protective factors (Catalano & Hawkins, 1995; Resnick, Bearman, Blum, Bauman, Harris, Jones, Tabor, Beuhring, Sieving, Shew, Ireland, Bearinger, & Udry, 1997; Rew, Thomas, Horner, Resnick, & Beuhring, 2001).

Interpretation of Block 1: The model chi-square value and its significance level will be examined to see if the relationship between ALCMON and individual risk factors is statistically significant ($p<.05$). The R^2 value will also be examined for evidence regarding the strength of that relationship – or how much of the variance in ALCMON is explained by individual risk factors.

Interpretation at Block 2: The model chi-square value and its significance level will be examined to see if the relationship between ALCMON and predictors entered into the analysis thus far (e.g. individual *and* individual protective factors) is statistically significant ($p<.05$). The R^2 value will also be examined to assess the strength of the relationship between ALCMON and individual risk *and* individual protective factors. Change in the R^2 value from Block 1 to Block 2 will be assessed as an indicator of how much additional variance, if any, in ALCMON is explained by the addition of individual protective factors.

Interpretation at Block 3: The model chi-square value and its significance level will be examined to see if the relationship between ALCMON and predictors entered into the analysis thus far (e.g. individual risk, individual protective, *and* social/environmental risk) iss statistically significant (p<. 05). The R^2 value will be examined for evidence of the strength of the relationship between ALCMON and the three domains entered at this point. Change in the R^2 value from Block 2 to Block 3 will be calculated to assess how much additional variance in ALCMON is explained by the addition of social/environmental risk factors.

Interpretation at Block 4: The model chi-square value and its significance level will be examined to see if the relationship between ALCMON and predictors entered into the analysis thus far (e.g. individual risk, individual protective, social/environmental risk, *and* social/environmental protective) is statistically significant (p<. 05). The R^2 value will be examined to assess the strength of the relationship between ALCMON and all four domains of the Risk-Protective Model of Prenatal Alcohol Consumption. Change in the R^2 value from Block 3 to Block 4 will be calculated to assess how much additional variance in ALCMON is explained by the addition of social/environmental protective factors.

Study Question #2

In order to address the question of determining the importance of predictors within each major domain (e.g. individual risk, social/environmental risk, individual protective, social/environmental protective), variables that have a

direct relationship to the dependent variable will be identified by statistically significant ($p < .05$) regression coefficients. The dependent variable (ALCMON – alcohol use in the past month) was coded as 0 = no and 1 = yes. Risk factors were coded positively in relation to the dependent variable (e.g. CIGMON - past month cigarette use - was coded as 0 = no and 1 = yes). Protective factors were coded negatively in relation to the dependent variable (e.g. SPIRITLY – religious beliefs influence decisions was coded as 0 = no and 1 = yes).

Variables in the individual and social/environmental risk domains with statistically significant ($p < .05$) positive regression coefficients will be identified as the most important significant risk factors. Variables in the individual and social/environmental protective domains with statistically significant ($p < .05$) negative regression coefficients will be identified as the most important protective factors.

Although it will be possible to identify significant predictors at each of the four steps in the analysis, variables will be identified as important predictors if they are statistically significant ($p <.05$) in the final step of the regression model, since these variables will have remained significant after all of the variables have been entered into the regression analysis. Once the significant variables are identified, their relative influence will be assessed by ranking them in terms of their regression coefficients and associated odds ratios.

Study Question #3

In order to explore variation in contributions of each domain, and of specific predictors within each domain, by ethnicity, separate logistic regression analyses will be conducted based on ethnicity following the strategy just outlined. Given the small numbers of pregnant females reporting recent alcohol use in ethnic groups other than Non-Hispanic White in both the 2001 and 2002 NSDUH, examination of differences by ethnicity will be limited to White versus Non-White pregnant females when analysis is completed using the two survey data years separately. Once data from the two years are combined, analysis will be expanded to examination of Non-Hispanic White, Hispanic, and Non Hispanic Black/African American subgroups.

Multivariate Analysis Strategy: Cross-Validation with 2002 NSDUH

Data from the subset of pregnant females in the 2002 NSDUH (n = 865) will be used as a cross-validation sample, with analysis strategy following the strategy presented above, after refining the model based on results using the 2001 cohort.

Goodness of fit tests (chi-square or t-tests) will then be conducted on a series of background variables, including ethnicity, income, and marital status, to assure comparability between the 2001 and 2002 cohorts. As with the 2001 data, variable measurement issues (dummy-coding and creation of new variables) will be addressed prior to running regression models using 2002 data.

Comparison of the findings from the final regression models using the separate 2001 and 2002 NSDUH data sets will be made on the following:

- R^2 value of full model,
- Significance level of the full model,
- Number of observations in the full model, and
- Statistically significant predictors in the full model.

Multivariate Analysis Strategy: Final Analyses Using Pooled 2001 and 2002 Cohorts

Data of pregnant females from the 2001 and 2002 NSDUH will be combined and the analysis strategy previously described followed. Issues related to variable measurement will be addressed prior to analysis with the combined data set. Analysis of differences between ethnic subgroups will be expanded to three groups – Non-Hispanic White, Hispanic, and Non-Hispanic Black/African American.

Power of the Proposed Study

Power calculations in logistic regression are complex (Hosmer & Lemeshow, 2000). With an initial total sample of 949 cases, the guideline of 15–20 cases per independent variables is well exceeded (Schwab, 2002). However, the ability to detect statistically significant predictors of prenatal alcohol consumption with 2001 NSDUH data only was especially challenging given that only 111 (11.7%) of pregnant women in the 2001 sample reported alcohol

consumption in the past month. According to guidelines suggested by Peduzzi and colleagues (1996), approximately 150 pregnant women would have to report recent alcohol use to meet the recommended 10 positive cases per covariate – e.g. the 111 positive cases from 2001 did not meet this parameter. However, once data from the 2001 and 2002 survey were pooled, this requirement was easily met, with over 200 pregnant women reporting alcohol consumption in the past month.

To further assess study power, analyses were conducted with Power Analysis and Sample Size (PASS) software from the Number Cruncher Statistical System (Hintze, 2001) using data from the 2001 NSDUH. PASS requires the user to designate desired odds ratios, significance levels, and the event rate - e.g., the rate of occurrence of the dependent variable in the sample. For this analysis, odds ratios were set at 1.5, alpha at .05, and the event rate at .117 (based on 11.7% of 2001 pregnant females reporting alcohol use). PASS does not ask for the number of predictor variables in the study, but rather estimates power and sample size requirements based on a primary independent variable. In the following test, analyses were conducted assuming a continuous predictor.

As seen in Figure 4-2, using a sample size of 950 (n = 949), PASS found the study to have 98% power using p of .05 to detect change in the dependent variable corresponding to an odds ratio of 1.5. Figure 4-3 also shows that the sample size of 949 exceeds the 618 cases needed to reach 90% power to detect

change in the dependent variable with a specified significance level of .05. Both of these assessments indicated the study had sufficient statistical power using the 2001 NSDUH data alone.

Figure 4-2
"PASS Study Power Analysis I"

Logistic Regression Power Analysis

Power	N	P0	P1	Ratio	Odds Squared	R Alpha	Beta
0.25568	100	0.117	0.166	1.500	0.000	0.05000	0.74432
0.45347	200	0.117	0.166	1.500	0.000	0.05000	0.54653
0.61689	300	0.117	0.166	1.500	0.000	0.05000	0.38311
0.74103	400	0.117	0.166	1.500	0.000	0.05000	0.25897
0.83001	500	0.117	0.166	1.500	0.000	0.05000	0.16999
0.89109	600	0.117	0.166	1.500	0.000	0.05000	0.10891
0.93164	700	0.117	0.166	1.500	0.000	0.05000	0.06836
0.95784	800	0.117	0.166	1.500	0.000	0.05000	0.04216
0.96709	850	0.117	0.166	1.500	0.000	0.05000	0.03291
0.97440	900	0.117	0.166	1.500	0.000	0.05000	0.02560
0.98015	950	0.117	0.166	1.500	0.000	0.05000	0.01985
0.98466	1000	0.117	0.166	1.500	0.000	0.05000	0.01534

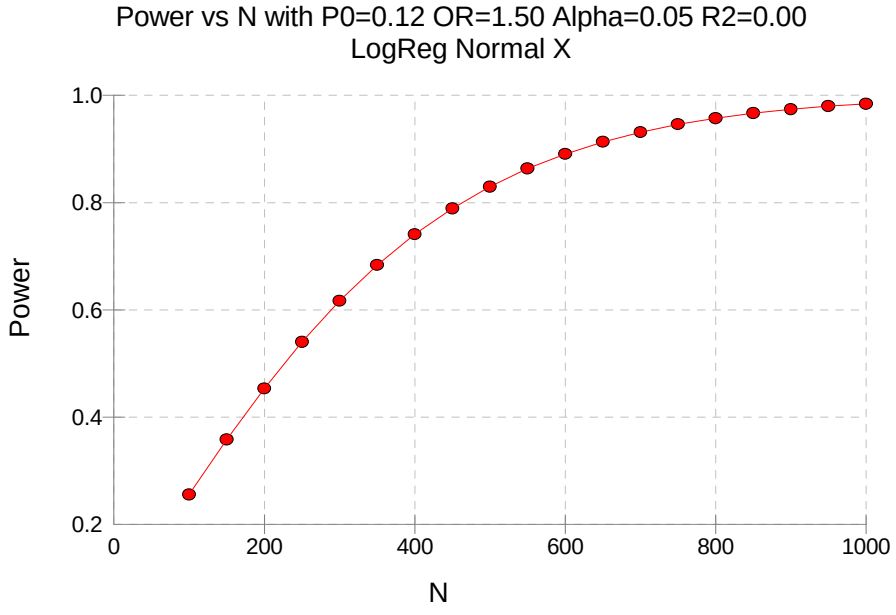
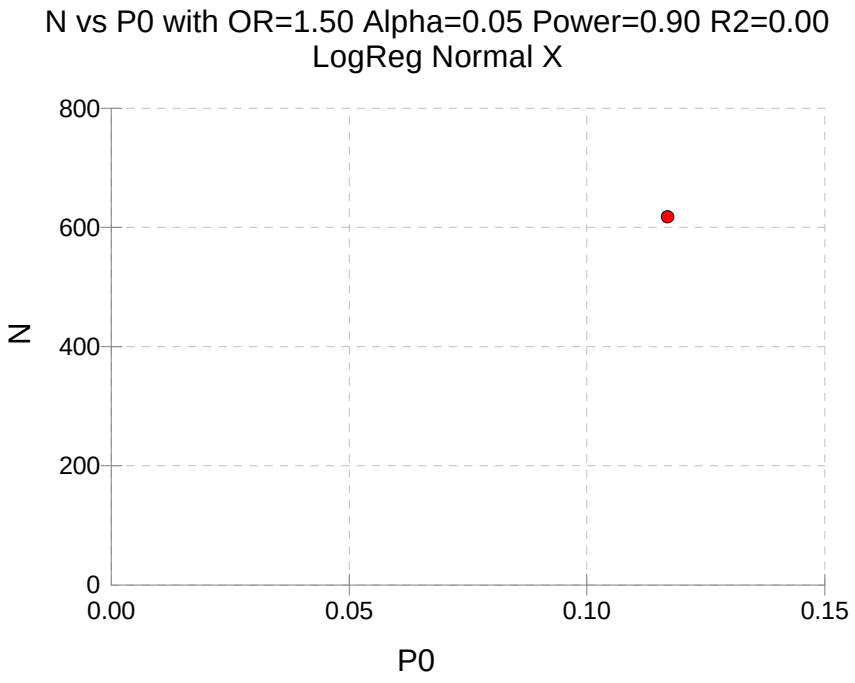


Figure 4-3
"PASS Study Power Analysis II"

Logistic Regression Power Analysis

Power	N	P0	P1	Ratio	Odds Squared	R Alpha	Beta
0.89970	618	0.117	0.166	1.500	0.000	0.05000	0.10030

Summary Statements
A logistic regression of a binary response variable (Y) on a continuous, normally distributed variable (X) with a sample size of 618 observations achieves 90% power at a 0.05 significance level to detect a change in Prob(Y=1) from the value of 0.117 at the mean of X to 0.166 when X is increased to one standard deviation above the mean. This change corresponds to an odds ratio of 1.5.



Chapter 5

Results

Preliminary descriptive analyses of pregnant females in the 2001 National Survey on Drug Use and Health (NSDUH), presented in the previous chapter, were obtained using SPSS. Because of the complex nature of the NSDUH data, it is preferable to utilize statistical software that can estimate variance and compute standard errors. Therefore, analyses from this point forward were conducted using Stata 8 and incoporated appropriate weighting variables.

Analyses of year-specific data (e.g. 2001 and 2002 NSDUH) were conducted separately and these results can be found in Appendix C. The limited number of cases, both in terms of positive cases on the dependent variable and more particularly, positive cases within ethnic subgroups, limited the value of findings from these separate analyses. Therefore, this chapter reports findings from the combined survey data.

Data Collapsing

To incorporate the stratum variance estimation variable “VESTRA” into analysis, it was necessary to collapse data using another variable. As seen in the frequency distribution presented in Table 5-1, there were very low numbers of cases per stratum in this subgroup of the original pooled sample.

Table 5-1
"Frequency Distribution of Cases per Strata:
Pooled Cohort"

#Cases per stratum	Frequency 2001 & 2002	% 2001 & 2002
1	568	53.48
2	332	31.26
3	98	9.23
4	45	4.24
5	12	1.13
6	4	0.38
7	1	0.09
8	1	0.09
9	1	0.09

Minimal cases per strata can cause problems with analyses using Stata because many tests cannot be executed when strata have only a single count. Over half of the strata in this study contain only a single case. Missing data compounds this issue, since additional single case strata are created when cases with missing data are removed from analyses. Additional single-case strata can also be created when analyses are limited to certain subsets of respondents.

Guidance on resolving these issues was sought from the author's contact with Substance Abuse and Mental Health Services Administration (SAMHSA),

which has funded this study. According to SAMHSA (2003, 2004), this issue is usually addressed by collapsing strata in order to eliminate those with single cases, but cautioned that researchers must use objective reasons to guide their decision making (SAMHSA, 2003, 2004). For example, a researcher studying schools might decide to collapse strata based on the number of students in each school.

Assistance with collapsing the data was obtained from Dr. Tom Bohman, a statistician with the University of Texas Information Technology Services. After careful consideration of the variables in the data set, it was decided to collapse cases into a new variable (NEWVESTR) based on the respondents' reported level of household income, since income was significantly correlated with pregnancy ($p < .001$) and socioeconomic status was a factor in the original sampling procedure. Furthermore, preliminary analysis of the income among the 2001 cohort (see Chapter 4) had indicated a relatively fair distribution of respondents across the seven categories of household income.

In order to conduct proposed analyses using the pooled 2001/2002 NSDUH data sets, including expansion of ethnic comparisons, it was necessary to collapse strata with eight cases or less. This was accomplished as seen in Table 5-2.

Table 5-2
"Distribution of Collapsed Cases by Income Level:
Pooled Cohort"

Income	Strata with 1 case	Strata with 2 cases	Strata with 3 cases	Strata with 4 cases	Strata with 5 cases	Strata with 6 cases	Strata with 7 cases	Strata with 8 cases	Tot
< $10,000	72	66	47	26	5	5	0	1	222
10K-19,999	92	113	43	40	7	4	1	4	304
20K-29,999	84	121	46	32	10	5	3	1	302
30K-39,999	90	104	36	26	2	2	2	1	263
40K-49,999	65	84	39	22	10	5	0	0	225
50K-74,999	91	106	47	20	19	2	0	1	286
$75,000+	74	70	36	14	7	1	1	0	203

Comparability of 2001 and 2002 Cohorts

To assure comparability between the 2001 and 2002 cohorts of pregnant females prior to pooling, findings from regression analyses of the 2001 and 2002 survey data were compared and goodness of fit tests conducted on variables in the Risk-Protective model.

Table 5–3 contains a summary of findings from the year-specific regression models (see Appendix C for complete analyses). The most notable difference between the 2001 and 2002 regression models was in the predictors that were statistically significant, although three variables (CIGMON, SUMMON, NEWTRIM) were significant for both cohorts.

While findings from the two survey data sets did not precisely replicate one another, there were a number of similarities across the two final regression models. The strength of both models was moderate, with the amounts of

variance in the dependent variable explained within 2% of each other. Both models had the same significance level ($p < .001$) and results of both models were based on observations from approximately 800 respondents.

Table 5-3
"Comparison of 2001 and 2002 Final Regression Models"

	2001 Cohort (N = 949)	2002 Cohort (N = 865)
R^2	.1977	.1759
Model significance level	.0000	.0000
Number of observations	819	779
Significant Predictors ($p \leq .05$)	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	ETHNIC CIGMON SUMMON NEWTRIM IRFAMIN3

Goodness of fit tests were also conducted on the variables in the Risk-Protective Model. As seen in Table 5-4, the two cohorts differed on only a single variable (SPIRITLY), with no significant differences detected between the 2001 and 2002 cohorts on the other fifteen variables.

Table 5-4
"Goodness of Fit X^2 Tests: 2001 vs 2002 Cohorts"

Variable	Chi Square Value	p value
Ethnicity (NEWRACE2)	17.6505	.2417
Ethnicity (ETHNIC)	1.3685	.4610
Age (NEWAGE)	2.1604	.3058
Marital Status (MARRIED)	2.1676	.2965
Mental (ADMHTX)	2.6528	.2492
Cigarette smoking (CIGMON)	.1451	.7754
Illicit drug use (SUMMON)	1.5969	.2352
Alcohol abuse/dependence (ABODALC)	1.5693	.4171
Religious influence (SPIRITLY)	8.7042	.0451*
Health insurance coverage (ANYHLTIN)	.4458	.6438
Government assistance (GOVTPROG)	2.0719	.3030
Friends who get drunk often (DRKFRDS)	.9191	.4017
Approached by drug seller (APPSELDG)	.0258	.8968
Household Income (IRFAMIN3)	9.6389	.6402
Employment Status (EMPLYD)	0.9125	.5358
Close friends (SNFCONC)	9.8155	.3870

*significant at $p < .05$

Based on comparison of regression model findings and results of goodness of fit tests indicating the two samples were comparable on virtually all model variables, the two cohorts appeared comparable and were combined for final analyses.

Analysis of the Pooled Cohort: 2001and 2002 NSDUH Pregnant Females

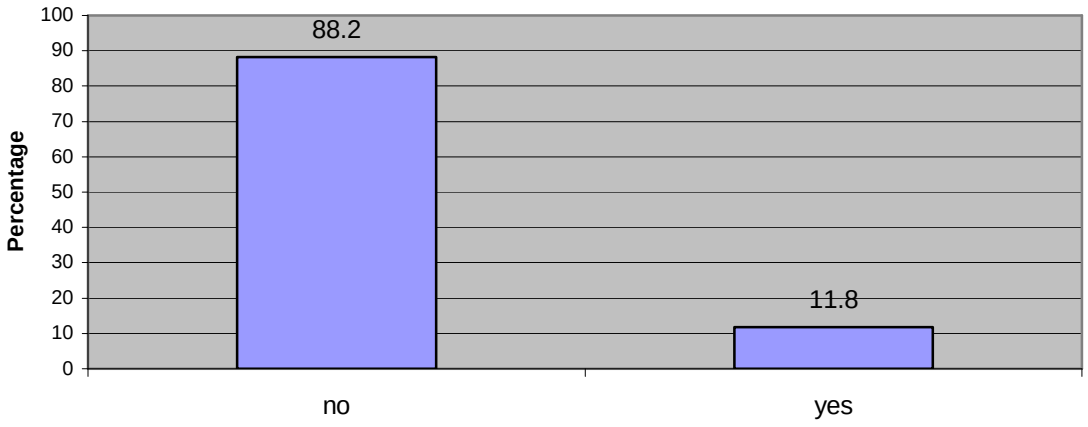
Descriptive analyses of the pooled cohort (2001 and 2002 NSDUH) of pregnant females were conducted using all variables in the Risk-Protective Model of Prenatal Alcohol Consumption, as well as additional variables to describe drinking characteristics of the cohort. Bivariate comparisons of pregnant females who reported recent alcohol use and those who did not were then made on many of these factors. Final testing of the Risk-Protective Model of Prenatal Alcohol Consumption was then conducted with the pooled data set.

Descriptive Analysis

Prevalence of Prenatal Alcohol Use

Among the 1814 pregnant females in the combined cohort, 212, or 11.84% (SE 1.12), reported alcohol consumption in the past month.

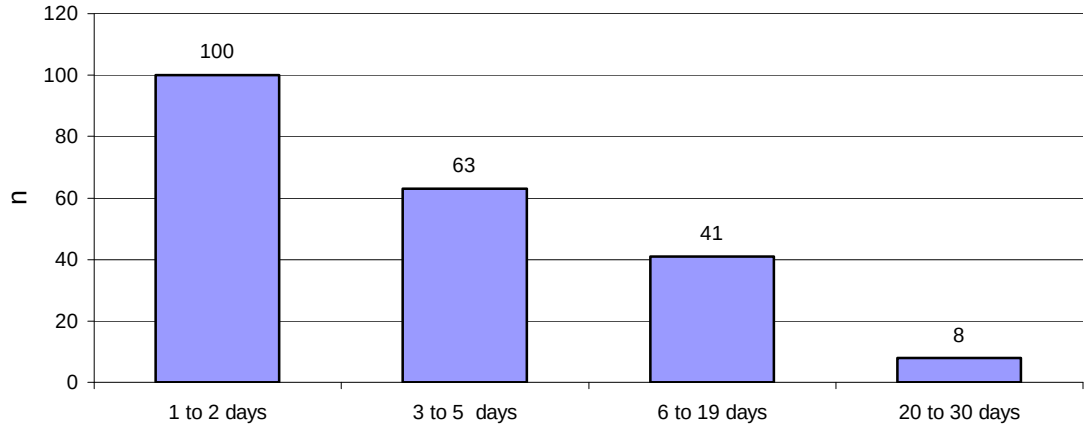
Figure 5-1
Alcohol Use among Pooled Cohort



Number of Days Drank (ALCMDAYS)

Figure 5-2 shows most pregnant females who reported drinking in the past month drank 1 to 2 days.

Figure 5-2
"Number of Days Drank in Past Month: Pooled Cohort"



Heavy Drinking

Heavy drinking, defined as drinking five or more drinks on the same occasion on each of 5 or more days in the past 30 days, was reported by less than 1% of pregnant women (0.90, SE 0.27). As would be expected, rates of recent alcohol use were much higher among pregnant females who reported heavy drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (11.04%, SE 1.10), and the difference was statistically significant (chi square (1) = 122.17, p = .0000).

Binge Drinking (BINGEDRK)

Binge drinking, defined as drinking five or more drinks on the same

occasion on at least 1 day, in the past 30 days, was reported by 90, or 4.04% (SE 0.62), of pregnant females in the pooled cohort (note that heavy drinkers are also counted as binge drinkers). As expected, the alcohol use rate was much higher among pregnant females who reported binge drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (8.13%, SE 1.00), and the difference was statistically significant (chi square (1) = 568.90, p = .0000).

Domain 1: Individual Risk Factors

Ethnicity (NEWRACE2)

Table 5-5 contains the ethnic distribution of all pregnant females in the pooled cohort, as well as rates of consumption for each group. The highest rates of drinking during pregnancy were reported by Non Hispanic pregnant females who were of more than one race (32.3%), followed by Non-Hispanic Native American/Alaskan Native (16.0%), and Non-Hispanic White pregnant females (14.1%). The rates of all three of these groups were above the use rate of the whole cohort (11.8%).

The lowest rates of consumption were among Non-Hispanic Asian pregnant females (4.0%). No Non-Hispanic Native Hawaiian pregnant females reported recent alcohol use.

Table 5-5
"Ethnic Comparison of Prenatal Alcohol Use Rates:
Pooled Cohort"

Ethnic Group	Group n (N=1814)	Group % (SE) Of 2001 Cohort	n of Group Reporting Use (n = 212)	% (SE) Recent Use within Group
Non-Hispanic White	1080	59.56 (1.79)	141	14.09 (1.57)
Hispanic	323	19.06 (1.57)	32	7.94 (1.90)
Non-Hispanic Black/African American	281	13.82 (1.15)	26	7.82 (2.18)
Non-Hispanic Asian	51	5.00 (0.93)	2	4.05 (3.20)
Non-Hispanic Native American/Alaskan Native	30	0.74 (.25)	3	15.97 (10.60)
Non-Hispanic, more than one race	40	1.65 (0.49)	8	32.30 (15.84)
Non-Hispanic Native Hawaiian/Other Pacific Islander	9	0.17 (0.07)	0	0.00 (0.00)

A chi square goodness of fit test of ethnic differences between pregnant females who had recently consumed alcohol and those who had not was significant (chi-square (6) = 32.0557, p = .0132). The largest difference in use rates were between Non-Hispanic pregnant females of more than one race (32%) and Non-Hispanic Asian pregnant females (4%).

Age (NEWAGE)

As seen in Table 5-6, respondents at least 26 years old had higher rates of alcohol use (12.8%) than respondents 25 and younger (10.5%), but the difference was not statistically significant (chi-square (1) = 2.26, p = .2472).

Table 5-6
"Rates of Prenatal Alcohol Use by Age:
Pooled Cohort "

	Alcohol Use N = 212	Alcohol Use % (SE)
< 26 years (n = 1328)	142	10.52 (1.00)
≥ 26 years (n = 486)	70	12.83 (1.81)

Marital Status (MARRIED)

As seen in Table 5-7, 13.6% of unmarried pregnant females reported recent alcohol use compared to 10.9% of married pregnant females, but the difference was not statistically significant (chi-square (1) = 2.98, p = .2169).

Table 5-7
"Rates of Prenatal Alcohol Use by Marital Status:
Pooled Cohort "

	Alcohol Use N = 212	Alcohol Use % (SE)
Married (n = 949)	92	10.89 (1.44)
Unmarried (n = 865)	120	13.65 (1.73)

Mental Health Problems (ADMHTX)

Among pregnant adult females, 203 (10.29%, SE 1.06) indicated they had received mental health treatment in the past year. Pregnant females who reported receiving such treatment had higher alcohol use rates (19.04%, SE 4.60) than those who did not (11.19%, SE 1.18) and the difference was statistically significant (chi square (1) = 8.93, p = .0493).

Alcohol Abuse or Dependence (ABODALC)

Among the pooled cohort, 132 (6.21%, SE 0.88) indicated a diagnosis of alcohol abuse or dependence in the past year. Pregnant females who reported such a diagnosis had higher consumption rates (35.32%, SE 7.10) than respondents without either diagnosis (10.28%, SE 1.06) and the difference was statistically significant (chi square (1) = 63.44, p = .0000).

Cigarette use (CIGMON)

As seen in Table 5-8, rates of alcohol consumption were much higher among pregnant females who also reported cigarette use in the past month (26.2%) compared to those who did not (8.7%). Results of a goodness of fit chi square test indicated a significant difference in smoking status between pregnant females who consumed alcohol in the past month and those who had not (chi square (1) = 78.55, p = .0000).

Table 5-8
"Rates of Prenatal Alcohol Use by Cigarette Use:
Pooled Cohort"

	Alcohol Use n = 212	Alcohol Use % (SE)
Cigarette smoker (n = 424)	100	26.21 (3.26)
Non-smoker (n = 1390)	112	8.69 (1.11)

Illicit drug use (SUMMON)

Less than 5% of pregnant females in the combined cohort reported using illicit drugs in the past month. Table 5-9 shows that respondents who used illicit

drugs in the past month had higher rates of alcohol consumption (45.1%) than those who did not recently use drugs (10.4%); the difference was statistically significant (chi square (1) = 82.24, p = .0000).

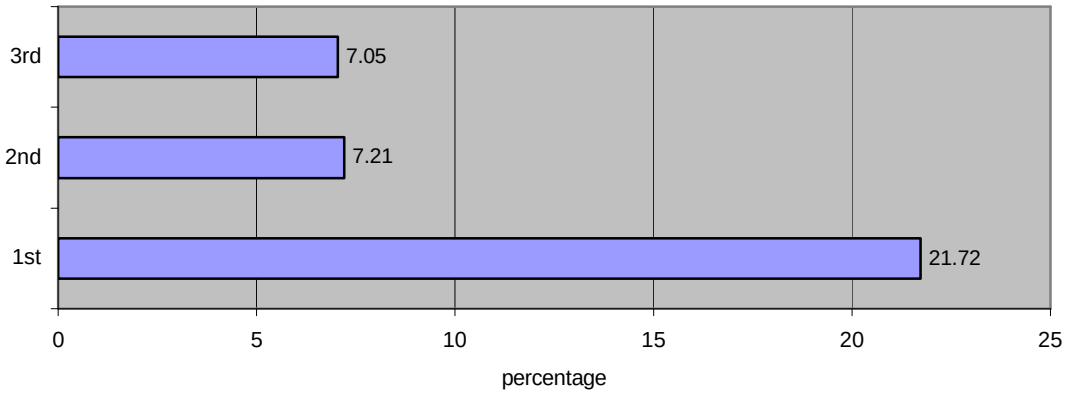
Table 5-9
"Rates of Prenatal Alcohol Use by Illicit Drug Use:
Pooled Cohort"

	Alcohol Use n = 212	Alcohol Use % (SE)
Used drugs (n = 112)	44	45.12 (6.29)
No drug use (n = 1702)	168	10.42 (1.11)

Trimester of Pregnancy

Among the combined cohort, 548 (31.04%, SE 1.69) were in their first trimester of pregnancy, 691 (38.17%, SE 1.77) in their second, and 303 (30.79%, SE 1.70) in their last. Figure 5-3 illustrates that the rate of alcohol consumption was highest among respondents in their first trimester of pregnancy (21.72%, SE 2.52) compared to those in their second (7.21%, SE 1.37) or third (7.05%, SE 1.84) trimester. The difference was statistically significant (chi square (2) = 79.58, p = .0000).

Figure 5-3
Rates of Prenatal Alcohol Use by Trimester:
Pooled Cohort



Domain 2: Social/Environmental Risk Factors

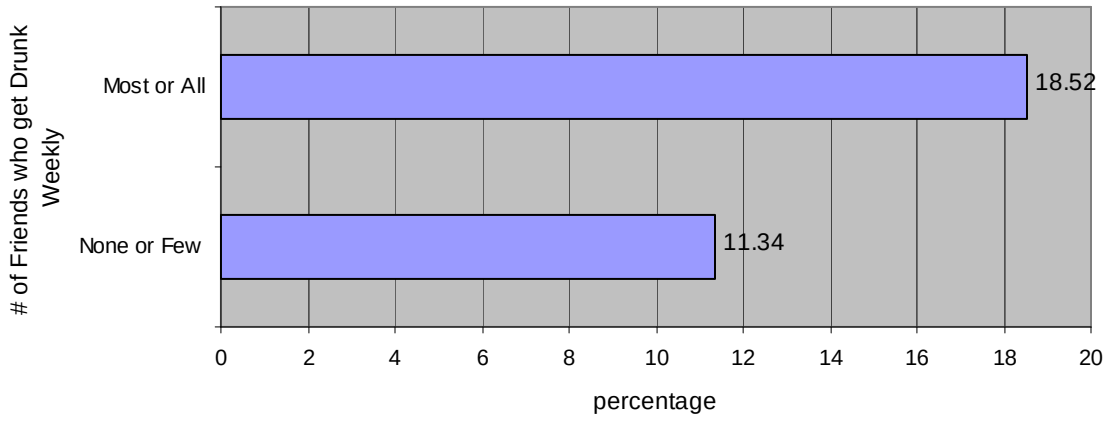
Government Program Participation (GOVTPROG)

Slightly more than 18% (n = 427) of all pregnant females indicated they were on at least one government assistance program. Pregnant females who received such assistance had a slightly higher consumption rate (12.77%, SE 2.62) than pregnant females that did not (11.63%, SE 1.24), but the difference was not statistically significant (chi square (1) = 0.34, p = .6856).

Friends who Get Drunk Regularly (DRKFRDS)

One hundred ninety-eight (198) pregnant females, or 6.95% (SE 0.68), reported that most or all of their friends got drunk at least once a week. As seen in Figure 5-4, pregnant females who reported this had higher rates of alcohol use (18.5%) than pregnant women who reported that none of few of their friends did (11.3%) and the difference was statistically significant (chi square (1) = 5.62, p = .0244).

Figure 5-4
Rates of Prenatal Alcohol Use by Friends:
Pooled Cohort



Opportunity to Buy Illegal Drugs (APPSELDG)

One hundred seventy-two (172), or 6.79% (SE 0.73), of the pregnant females in the pooled cohort indicated someone selling drugs had approached them in the past month. Pregnant females who indicated they had a recent opportunity to buy drugs had a higher alcohol use rate (23.29%, SE 4.29) than respondents without such an opportunity (11.05%, SE 1.16) and the difference was statistically significant (chi square (1) = 16.41, p = .0006).

Domain 3: Individual Protective Factors

Spirituality (SPIRITLY)

Pregnant females who indicated that religious beliefs influenced their decisions (n = 1288) had lower rates of alcohol consumption (11.47, SE 1.35)

than respondents who indicated that religion was not important (n = 498) in their life (13.51%, SE 2.04), but the difference was not statistically significant (chi-square (1) =1.29, p =.3945)

Insurance coverage (ANYHLTIN)

Among pregnant females in the pooled cohort, 8.42% (SE 0.94) indicated they did not have health insurance coverage. Similar rates of alcohol use were seen among pregnant females with health insurance (11.74%, 1.19) and those without health insurance (12.44%, 2.98), and there was no statistically significant difference (chi square (1) = 0.06, p = .8261).

Domain 4: Social/Environmental Protective Factors

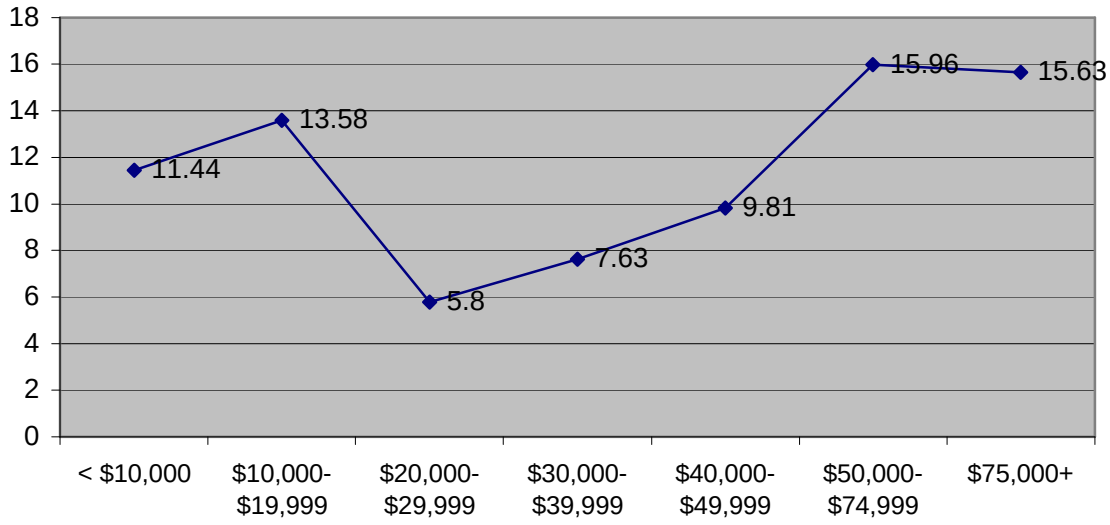
Income (IRFAMIN3)

As seen in Figure 5-5, pregnant females with household incomes in the two highest income brackets had the highest alcohol use rates. Pregnant females with incomes between $50,000-74,999 had an alcohol use rate of 15.96% (SE 3.39), and the use rate for pregnant females with incomes above $75,000 was 15.63% (SE 3.29). The lowest alcohol consumption rates were seen among pregnant females with incomes between $20,000 - $29,999 (5.80%, SE 1.29) and those with incomes between $30,000 - $39,999 (7.63%, SE 2.06).

A goodness of fit chi square test indicated a significant difference in annual household income between pregnant females who reported recent alcohol use and those that did not (chi-square (6) = 25.18, p = .0337). The

largest discrepancies were seen between those with household incomes above $50,000 who had the highest use rates (16%), and those with incomes between $20,000 and $29,999, who had the lowest use rate (6%).

Figure 5- 5
Rates of Prenatal Alcohol Use by Income
Pooled Cohort



Employment Status (EMPLYD)

As seen in Table 5-10, pregnant females who were employed had higher rates of recent alcohol use (12.9%) than those who were unemployed (10.6%), but the difference was not statistically significant (chi square (1) = 1.03, p = .3103).

Table 5-10
"Rates of Prenatal Alcohol Consumption by Employment Status
Pooled Cohort"

	Alcohol Use N = 212	Alcohol Use % (SE)
Employed (n = 964)	127	12.88 (2.05)
Unemployed (n = 850)	85	10.58 (1.62)

Supportive friends (SNFCONC)

Table 5-11 shows the highest rates of alcohol use among pregnant females with the most number of close friends (14.8%) and those with no close friends (13.9%) with whom they share personal issues and concerns. The lowest rates of alcohol use were seen among pregnant females with four or five close friends (10.2%). Results of a goodness of fit chi square test indicated no significant difference in the number of close friends between pregnant women who report recent alcohol consumption and those who did not (chi square (4) 2.93, p = .8420).

Table 5-11
"Number of Close Friends by Consumption Status:
Pooled Cohort"

	Alcohol Use % (SE)
None	13.88 (3.64)
1	10.84 (2.33)
2 or 3	11.86 (1.71)
4 or 5	10.22 (3.03)
More than 5	14.76 (4.10)

Descriptive Summary of Pooled Cohort

Pregnant females (N = 1814) in the pooled cohort were predominantly Non-Hispanic White (60%), married (66%), and employed (55%). The majority of pregnant females reported having health insurance (92%) and that spirituality was an important influence in their life (79%).

The alcohol use rate was 12%, with the majority of respondents reporting drinking 1 to 2 days in the past month. Rates of past month binge drinking and illicit drug use were 4%, and 7% of respondents reported that most of their friends got drunk at least once a week. During the month prior to participating in the survey, 18% smoked cigarettes and 7% were approached by someone sellng illegal drugs.

Table 5-12 summarizes comparisons between pregnant females in the pooled cohort who reported alcohol consumption within the past month and those who did not drink any alcohol.

Table 5-12
"Summary of Bivariate Comparisons:
Pooled Cohort"

Characteristic	Chi square value	p value
Domain 1: Individual Risk Factors		
Ethnicity, 7 categories	32.0557	p = .0132*
Age	2.622	p = .2472
Marital status	2.9809	p = .2169
Mental health problems	8.9331	p = .0493*
Alcohol abuse or dependence	63.4382	p = .0000***
Cigarette use	78.5536	p = .0000***
Illicit drug use	82.2366	p = .0000***
Trimester	79.5831	p = .0000***
Domain 2: Social Environmental Risk Factors		
Government program participation	0.3425	p = .6856
Friends who get drunk regularly	5.6177	p = .0244*
Opportunity to buy illegal drugs	16.4085	p = .0006***
Domain 3: Individual Protective Factors		
Spirituality	1.2909	p = .3945
Health insurance coverage	0.0641	p = .8261
Domain 4: Social/Environmental Protective Factors		
Income	25.1843	p = .0337*
Employment status	2.2838	p = .3103
Close friends	2.9331	p = .8420

* significant at .05 level **significant at .01 level ***significant at .001 level

There was a significant difference on one protective factor – total household income (IRFAMIN3), which was also seen in the 2002 cohort, but not in the 2001

cohort. Significant differences between pregnant women who consumed alcohol and those that did not in the pooled cohort were also seen on a number of risk factors including the non-collapsed ethnicity variable (NEWRACE2). Like at least one of the year-specific analyses, significant differences in the pooled sample were also seen on:

- mental health problems (ADMHTX), with those who received treatment in the past year reporting higher rates of use
- alcohol abuse or dependence (ABODALC), with those having either diagnosis reporting higher rates of use
- cigarette smoking (CIGMON), with smokers reporting higher rates of use
- illicit drug use (SUMMON), with drug users reporting higher rates of use, and
- trimester (NEWTRIM), with those in the first trimester reporting higher rates of use.

Although there was a significant age difference between respondents who reported drinking and those who did not in the 2001 cohort, this difference was not seen in the pooled cohort. In addition, DRKFRDS, a measure of how many friends that get drunk weekly, was significant in the pooled cohort, although it was not in separate 2001 or 2002 analyses.

Significant differences were seen on additional descriptive variables of binge drinking and heavy drinking, which were not added to the model because both

variables would perfectly predict the dependent variable.

Testing of the Risk-Protective Model: Pooled Cohort

All Pregnant Females

Results of regression models with the pooled cohort of all pregnant females are seen in Table 5-13. The model was statistically significant at each step, but the addition of individual protective factors (Domain 2), social/environmental risk factors (Domain 3), and social/environmental protective factors (Domain 4) had little impact on the model R^2 value. In the final model, only individual risk factors and a single protective factor remained statistically significant. The final model, which demonstrated a moderate relationship between the predictors and dependent variable, explained approximately 17% of prenatal alcohol consumption among the pooled cohort.

Table 5-13
"Logistic Regression Findings in Pooled Cohort:
All Pregnant Females"

	Domain 1	Domains 1, 2	Domains 1, 2, 3	Full Model
R^2	.1471	.1469	.1587	.1663
Δ in R^2	N/A	-.0002	+ .0018	+.0076
p of model	p < .001	p < .001	p < .001	p < .001
Significant Coefficients $p \leq .05$	ETHNIC NEWAGE ABODALC CIGMON SUMMON NEWTRIM	ETHNIC NEWAGE ABODALC CIGMON SUMMON NEWTRIM	ETHNIC NEWAGE ABODALC CIGMON SUMMON NEWTRIM	NEWAGE ABODALC CIGMON SUMMON NEWTRIM IRFAMIN3
# of cases	1652	1625	1601	1598

Significant Predictors in Pooled Cohort: All Pregnant Females

Table 5-14 contains additional information on variables that remained statistically significant in the full model. SUMMON, past month illicit drug use, was the most influential predictor. Pregnant females who used drugs were over 4 times as likely to consume alcohol than non-users. Respondents with a diagnosis of alcohol abuse or dependence in the past year (ABODALC) were over 3 times as likely to consume alcohol, as were those in their first trimester. Cigarette smokers (CIGMON) were over 2 ½ times as likely to drink alcohol while pregnant. Respondents who were 26 years and older were 1 ½ times more likely to drink than those 25 years and younger. Contrary to expectations, higher annual household income was associated with an increased risk for drinking during pregnancy.

Table 5-14
"Statistically Significant Predictors in Pooled Cohort:
All Pregnant Females"

	B	SE	95% CI	t	P	Odds Ratio
Individual Risk:						
NEWAGE	.46	.234	-.0002 .917	1.96	.050	1.58
ABODALC	1.31	.494	.342 2.279	2.65	.008	3.71
CIGMON	1.09	.268	.566 1.615	4.08	.000	2.76
SUMMON	1.42	.368	.701 2.146	3.86	.000	4.15
NEWTRIM	1.22	.246	.739 1.704	4.97	.000	3.39
Individual Protective: None	---	---	---	---	---	---
Social/Env Risk: None	---	---	---	---	---	---
Social Env Protective: IRFAMIN3	.14	.074	-.002 .287	1.93	.054	1.15

Regression Analyses Results: Ethnic Comparisons

Table 5-15 contains findings from separate regression analyses of all, Non-Hispanic White, Hispanic, and Non-Hispanic Black/African American pregnant females. (Note that from this point forward Non-Hispanic White will be referred to as "White" and Non-Hispanic Black/African American will be referred to as "Black".)

The strength of the model with all pregnant females in the pooled cohort was very similar to the model containing the subgroup of White respondents, with both models explaining approximately 17% of the variance in the dependent variable. The models for both the Hispanic and Black subgroups were stronger

than that of the larger cohort. The model using Hispanic respondents explained 26% of the variance in past month alcohol consumption and the model using Black respondents explained almost 33% of the variance.

Although age was a significant variable in the model with all pregnant females, it was not in any of the three subgroup models. In contrast, a diagnosis of alcohol abuse or dependence in the past year (ABODALC), past month cigarette smoking (CIGMON), and past month illicit drug use (SUMMON) remained statistically significant across all three subgroups. Trimester of pregnancy (NEWTRIM) remained significant among White and Hispanic respondents, but not among Black pregnant females. Income (IRFAMIN3), remained significant only for White pregnant females.

Some variables that were not significant in the larger cohort emerged as important among particular subgroups. Participation in a government assistance program (GOVTPROG) and the number of friends who get drunk regularly (DRKFRDS) were statistically significant predictors for Hispanic pregnant females. Importance of religious beliefs in life (SPIRITLY) and employment status (EMPLYD) were important predictors among Black pregnant females.

Table 5-15
"Logistic Regression Findings in Pooled Cohort:
Ethnic Comparisons"

	All Pregnant Females	White Pregnant Females	Hispanic Pregnant Females	Black Pregnant Females
R^2	.1663	.1743	.2603	.3272
p of model	p < .001	p < .001	p < .001	p < .001
Significant Coefficients p < .05	NEWAGE ABODALC CIGMON SUMMON NEWTRIM IRFAMIN3	 ABODALC CIGMON SUMMON NEWTRIM IRFAMIN3	 ABODALC CIGMON SUMMON NEWTRIM GOVTPROG DRKFRDS	 ABODALC CIGMON SUMMON SPIRITLY EMPLYD
# of cases	1598	983	268	238

Significant Predictors in Pooled Cohort: White Pregnant Females

Table 5-16 shows that SUMMON (past month illicit drug use) was the most influential predictor among White pregnant females. Drug users were over 6 times as likely to drink alcohol during pregnancy than non-users. The next most influential predictor among White respondents was ABODALC (a diagnosis of alcohol abuse or dependence in the past year). Respondents diagnosed with alcohol abuse or dependency were over 5 times more likely to consume alcohol than those without such a diagnosis. Respondents in their first trimester of pregnancy were over 4 times as likely to drink during pregnancy than those in

their second or third trimester. Cigarette smokers were 2.5 times as likely to engage in prenatal alcohol consumption. Income, which was conceptualized as a protective factor, had findings opposite to what was expected, with higher household income associated with a greater risk for alcohol use.

Table 5-16
"Statistically Significant Predictors in Pooled Cohort:
White Pregnant Females"

	B	SE	95% CI	t	p	Odds Ratio
Individual Risk: ABODALC	1.68	.606	.492 2.872	2.77	.006	5.38
CIGMON	.93	.348	.244 1.611	2.66	.008	2.53
SUMMON	1.84	.493	.873 2.809	3.73	.000	6.30
NEWTRIM	1.46	.291	.892 2.033	5.03	.000	4.32
Individual Protective: None	---	---	---	---	---	---
Social/Env Risk: None	---	---	---	---	---	---
Social Env Protective: IRFAMIN3	.19	---	---	1.94	.052	1.21

Significant Predictors in Pooled Cohort: Hispanic Pregnant Females

As seen in Table 5-17, SUMMON was the most influential predictor among Hispanic pregnant females, with those who recently used illicit drugs 37 times more likely to drink than non-users. Current smokers (CIGMON) were over 9 times as likely to drink during pregnancy than non-smokers and respondents in their first trimester almost 4 times as likely to also use alcohol. Interestingly, a diagnosis of alcohol abuse or dependence (ABODALC) was associated with a

lower risk of drinking alcohol among Hispanic respondents.

Two variables in the social/environmental risk domain were significant. Participation in a government assistance program (GOVTPROG) was actually associated with a slightly lower risk of alcohol consumption. While the direction of that relationship was unexpected, the anticipated relationship between prenatal alcohol consumption and a social support system in which there is a large amount of drinking was found. Respondents who reported that most or all of their friends got drunk at least once a week (DRKFRDS) were 2.5 times more likely to consume alcohol during pregnancy than those who reported that none or few of their friends routinely got drunk.

Table 5-17
"Statistically Significant Predictors in Pooled Cohort:
Hispanic Pregnant Females"

	B	SE	95% CI	t	p	Odds Ratio
Individual Risk:						
ABODALC	-2.97	1.366	-5.665 -.285	-2.18	.030	.05
CIGMON	2.24	1.070	.129 4.344	2.09	.038	9.36
SUMMON	3.61	.974	1.694 5.529	3.71	.000	37.02
NEWTRIM	1.37	.582	.224 2.516	2.35	.019	3.93
Individual Protective:						
None	---	---	---	---	---	---
Social/Env Risk:						
GOVTPROG	-1.89	.944	-3.749 -.032	-2.00	.046	.15
DRKFRDS	2.29	.857	.603 3.981	2.67	.008	2.62
Social Env Protective:						
None	---	---	---	---	---	---

Significant Predictors in Pooled Cohort: Black Pregnant Females

Table 5-18 contains information on the significant predictors among the pooled cohort of Black pregnant females. Two individual risk factors, both substance-related, were significant. Cigarette smoking was the most influential predictor of alcohol use during pregnancy among Black respondents, with current smokers over 33 as likely to drink alcohol. Respondents with a diagnosis of alcohol abuse or dependence were over 14 times as likely to consume alcohol.

Two protective factors, one individual (SPIRITLY) and one social/environmental (EMPLYD), emerged as significant among Black pregnant females. Respondents who indicated that their religious beliefs were important in their life (SPIRITLY) were less likely to consume alcohol. Opposite of expectations, employed respondent were 3 times more likely to drink than those who were unemployed.

Table 5-18
"Statistically Significant Predictors in Pooled Cohort:
Black Pregnant Females"

	B	SE	95% CI	t	P	Odds Ratio
Individual Risk:						
ABODALC	2.66	1.237	.220 5.093	2.15	.033	14.25
CIGMON	3.52	1.403	.753 6.281	2.51	.013	33.69
Individual Protective:						
SPIRITLY	-1.75	.909	-3.543 .039	-1.93	.055	.17
Social/Env Risk:						
None	---	---	---	---	---	---
Social Env Protective:						
EMPLYD	1.18	.574	.052 2.314	2.06	.040	3.26

Summary of Significant Predictors across All Groups

Table 5-19 indicates which predictors were statistically significant in the final regression analyses of the subgroups of White, Hispanic, and Black pregnant females.

Table 5-19
"Significant Predictors by Domain among
White, Hispanic, and White Pregnant Females"

Domain: Concepts	Variable (Definition)	Significant Among
Individual Risk:		
Age	NEWAGE (< or ≥ 26)	
Marital status	MARRIED (married or unmarried)	
Mental health problems	ADMHTX (past year mental health treatment)	
Substance use/ problems	ABODALC (past year alcohol abuse or dependence)	White, Hispanic[a], Black
	CIGMON(past month cigarette use)	White, Hispanic, Black
	SUMMON (past month illicit drug use)	White, Hispanic
Trimester of pregnancy	NEWTRIM (1st vs. 2nd/3rd trimester)	White, Hispanic
Individual Protective:		
Spirituality	SPIRITLY (religious beliefs important and influence decisions)	Black
Service access	ANYHLTIN (health insurance coverage)	

Table 5-19 continued

Social/Environmental Risk: Negative social influence Negative community influence Economic vulnerability	DRKFRDS (# of friends that get drunk at least once a week) APPSELDG (past month opportunity to buy drugs) GOVTPROG (government assistance program participation)	Hispanic Hispanic[a]
Social/Environmental Protective: Economic stability Social support	IRFAMIN3 (household income) EMPLYD (employment status) SNFCONC (# of friends share concerns with)	White[a] Black[a]

[a]findings opposite of expected

In terms of individual risk factors, cigarette smoking was the lone predictor that remained significant across all three ethnic subgroups. In contrast, age, which was significant for the pooled cohort, was not a significant predictor of prenatal alcohol use for any of the three ethnic subgroups. Neither marital status (MARRIED) nor past year mental health treatment (ADMHTX) were significant individual risk factors among any ethnic subgroup. The remaining individual risk factor variables of past year alcohol abuse or dependence (ABODALC), past month illicit drug use (SUMMON), and trimester of pregnancy (NEWTRIM) were significant for two of the three subgroups.

The only significant individual protective factor was the importance of religious beliefs in life (SPIRITLY), but this predictor was only significant among Black respondents. Having health insurance (ANYHLTIN) was not a significant protective factor among any ethnic group or the pooled cohort.

No social/environmental risk factors were significant among White or Black pregnant females. However, having friends who get drunk weekly (DRKFRDS) was a significant risk factor among Hispanic respondents. Enrollment in at least one government assistance program (GOVTPROG) was significant for Hispanics, but in a manner contrary to expectations. Having been approached by someone selling drugs in the past month (APPSELDG) was not an important risk factor among any of ethnic subgroups of pregnant females.

In terms of social/environmental protective factors, two variables were significant, but both were opposed to the expected direction of the relationship. Annual household income (IRFAMIN3) was significant among White respondents and employment status (EMPLYD) was significant among Black respondents.

Conclusion

The Risk-Protective Model contains individual variables and domains of influence that emerged as important predictors of prenatal alcohol use, and these predictors appear to vary substantially by ethnicity. These findings, as well as implications for social work research and practice, are discussed in the next chapter.

Chapter 6

Discussion

This chapter discusses study findings, beginning with a consideration of the original questions posed in this study. Study limitations are also addressed. Finally, the implications for future research, continued theory development, and current practice are discussed.

Questions Posed by this Study

The original research questions posed by this study were:

- What contributions do differing domains make toward explaining variance in alcohol use among pregnant women?
- What are the most important predictors within each major domain in this study?
- Does there appear to be any difference in the contributions of each domain and/or the importance of specific predictors among women of different ethnic backgrounds?

Contributions of the four major domains (individual risk, individual protective, social/environmental risk, social/environmental protective) and differences in those contributions by ethnicity are addressed first, followed by discussion of the most important individual predictors within each domain and variations in them among the ethnic subgroups.

Importance of Domains

Examining R^2 values and changes in R^2 values at each step in the ethnic specific regression models, seen in Table 6-1, provides information on the relative contributions made by each domain and variations in those contributions by ethnicity.

Table 6-1
"Ethnic Specific Regression Models:
Influence of Domains in the Risk-Protective Model"

	Model R^2 (% Δ) White	Model R^2 (% Δ) Hispanic	Model R^2 (% Δ) Black
Individual Risk	.1480	.1134	.2336
Individual Protective	.1507 (+0.27)	.1546 (+4.12)	.2507 (+1.71)
Social/Environmental Risk	.1629 (+1.22)	.2245 (+6.99)	.2940 (+4.33)
Social/Environmental Protective	.1743 (+1.14)	.2603 (+3.58)	.3272 (+3.32)

Among White respondents, individual risk factors explained 14.8% of drinking during pregnancy. This accounts for 84.9% of the total explained variance (17.43%), making this domain the most influential among White pregnant females. The individual protective factor domain explained only 0.3% of prenatal alcohol consumption, or 1.5% of the total explained variance. Both social/environmental factor domains contributed slightly more than 1% each to the understanding of drinking during pregnancy among this subgroup, with the social/environmental risk domain accounting for 7.0% and the

social/environmental protective domain accounting for 6.5% of the total variance among White respondents.

Among Hispanic respondents, individual risk factors explained 11.3% of recent drinking. Accounting for 43.6% of the total explained variance among this subgroup, the individual risk factor domain was the most influential. Social/environmental risk factors increased the amount of variance explained by almost 7% and accounted for approximately 27% of the total explained variance, making it the next most influential domain among Hispanic respondents. The individual protective factor and the social/environmental domains both explained approximately 4% of the recent alcohol consumption, or 15.8% and 13.7% respectively of the total explained variance.

Among Black pregnant females, the individual risk factor domain explained over 23% of drinking during pregnancy, which represents over 71% of the total variance explained and makes it the most influential domain among this ethnic subgroup. Social/environmental risk factor domains accounted for 4.3% of recent drinking, or slightly more than 13% of the total explained variance, among this respondent group. Social/environmental protective factors accounted for just over 3% of recent drinking, or 10% of the total explained variance, among this ethnic subgroup. The individual protective factor domain explained only 1.7% of prenatal alcohol consumption, or just over 5% of the total explained variance.

Table 6-2 summarizes the contribution each domain made toward the total

amount of variance explained among each ethnic subgroup. Regardless of ethnic background, the individual risk factor domain accounted for the largest proportion of explained variance. This is not surprising since individual risk factors, as opposed to social/environmental risk or protective factors, are the most frequently studied type of predictor in the literature on prenatal alcohol consumption. Furthermore, it may simply be that the individual risk domain is the most critical when it comes to predicting prenatal alcohol consumption.

Table 6-2
"Proportion of Total Explained Variance by Domains"

	White	Hispanic	Black
Individual Risk	84.91%	43.56%	71.39%
Individual Protective	1.55%	15.83%	5.23%
Social/Environmental Risk	7.00%	26.85%	13.23%
Social/Environmental Protective	6.54%	13.75%	10.15%

For the subgroups of White and Black pregnant females, the individual risk factor domain was clearly the most important domain in terms of understanding recent drinking, with the individual protective domain having the most limited impact. The social/environmental domains, both risk and protective, had modest impact among both White and Black respondents, although the impact was of a greater proportion in both domains among Black respondents.

The individual risk factor domain was also the most influential among

Hispanic pregnant females, but social/environmental risk factors made a substantial contribution to the amount of variance explained among this ethnic subgroup. Both protective domains also made moderate contributions.

Importance of Individual Predictors

Table 6-3 summarizes those variables that remained significant, and whose relationship with the dependent variable was in the anticipated directions, in the final ethnic-specific regression models. Several variables from the individual risk domain and one variable from each of the individual protective and social/environmental domains emerged as the most important predictors in the Risk-Protective Model of Prenatal Alcohol Consumption. No social/environmental protective factors performed in the expected manner.

Table 6-3
"Significant Variables by Domain"

Domain	Concept: Variable	Significant Among
Individual Risk	Substance use/ problems	
	ABODALC	White, Black
	CIGMON	White, Hispanic, Black
	SUMMON	White, Hispanic
	Trimester of pregnancy: NEWTRIM	White, Hispanic
Individual Protective	Spirituality: SPIRITLY	Black
Social/Environmental Risk	Negative social influence: DRKFRDS	Hispanic
Social/Environmental Protective	None	

In terms of individual risk factors, cigarette smoking remained significant across all three ethnic groups. Three additional risk factor variables-- alcohol abuse or dependence in the past year, illicit drug use, and trimester of pregnancy --remained significant for two of the three ethnic subgroups.

In addition to individual risk factors, one measure of negative social influence in the social/environmental risk domain was an important predictor. The variable that measured the number of friends who got drunk regularly was statistically significant among Hispanic respondents.

One variable from the individual protective domain was statistically significant among Black pregnant females. Spirituality, which measured the influence of religious beliefs in life, was associated with a decreased likelihood of drinking during pregnancy among this group of respondents.

Some of these findings echo those of previous research and serve as confirmation that indicators of substance use such as cigarette smoking, alcohol abuse/dependence, and illicit drug use are generally important predictors of those females who are most likely to consume alcohol during pregnancy.

However, not all findings in this study are consistent with prior research. Age and ethnicity are often cited as important risk factors, yet ethnicity was not statistically significant among the pooled cohorts, nor was age statistically significant when ethnic-specific regression analyses were conducted. And, although the research literature on factors other than individual risk is rather

limited, findings from this study also illustrate that much work remains to be done in identifying variables of social/environmental risk and those that may serve in protective capacities across all three ethnic subgroups.

Limitations of the Study

Several limitations of this research must be acknowledged. This study only included analysis of three ethnic groups--e.g. White, Hispanic, and Black. Although analyses of other ethnic groups were not possible given the number of respondents in them, research with other groups is warranted since drinking during pregnancy cuts across lines of ethnicity.

Issues related to sample size raise another shortcoming of this research. Despite a large pooled cohort (N = 1,814), with only 212 positive on the dependent variable, the number of Hispanic (n = 32) and Black (n = 26) respondents who reported recent alcohol use was smaller than desired, for statistical purposes, indicating the need to interpret findings from these groups with caution.

Other study weaknesses are associated with the Risk-Protective Model proposed in this study. Three concepts in the original model (personal competency, positive home environment, and reproductive history) were not included in analysis due to lack of appropriate measures, meaning that some possibly critical predictors went undetected.

Findings from the final regression models also indicated that six measures

were not significant among any of the three ethnic subgroups. Such results suggest the possibility that some of the variables used may not have been the best measure of the concepts being studies and may have resulted in undetected significant predictors. For example, adult mental health treatment in the past year not only excluded youth, but also would have failed to capture respondents who had sought treatment for their problems more than one year before being interviewed. Additionally, the meaning of spirituality may differ for women of different ethnic backgrounds and the measure used in this study may not reflect such variation in this concept. Although some findings, particularly related to variables in the protective domains, were not as strong as expected, research on protective factors in this population is really in its infancy.

Some measures were significant but in the direction opposite of expected, including income and White respondents, alcohol abuse or dependence and Hispanic respondents, and participation in government assistance and Hispanic respondents. Although conceptualized as a protective factor in the original model, higher income was actually found to be associated with a greater risk for alcohol use among White respondents. This correlation has actually been found in prior research, so this finding was not completely surprising.

A recent diagnosis of alcohol abuse or dependence, as well as receiving some form of government assistance were both associated with a decreased likelihood for drinking among Hispanic respondents. It is possible that those who

had been diagnosed with alcohol problems had received treatment and were no longer drinking and that those on government assistance had access to programs such as Medicaid and/or the Women, Infants, and Children (WIC) program where they may have received prenatal education, including advice to refrain from alcohol use during pregnancy.

Findings that were in the opposite direction of expected certainly warrant further examination and may serve an illustration of how a single factor can influence behavior differently among individuals whose ethnic backgrounds vary. It is hoped that future research will attempt to continue the development of ethnic-specific models of prenatal alcohol use, making adjustments to reflect findings from this study.

Finally, social desirability bias should be addressed since the issue of full disclosure often arises in the study of alcohol and other drug use, the likelihood of which could increase when the respondents are pregnant females. All respondents were informed that the information that they provided would be kept confidential and used solely for purposes of research. In addition, since the question of pregnancy status was asked at the end of the survey after the substance use questions had been covered, the likelihood of any socially desirable responses is virtually eliminated.

Despite the limitations outlined above, this study has a number of strong points, including the use of a nationally representative sample and a multivariate

analysis strategy using a theory-based conceptual model. This research also provides a vital starting point for the exploration of possible factors that help reduce the risk of prenatal alcohol consumption.

Implications for Research

Findings from this study have a number of implications for future research, including the need to expand examination of risk and protective factors related to prenatal alcohol consumption to other ethnic subgroups. Research with pregnant females who are Native American and Hispanic of more than one race seems particularly critical, given that findings from this study that indicate use rates within these two ethnic groups are above those of the pooled cohort. Compared to the alcohol use rate among respondents in the pooled cohort (12%), the use rates reported by pregnant females who are Native American and Hispanic of more than one race are 16% and 32%.

In addition to studying additional ethnic groups, several issues related to concept measurement emerged from this study. As noted earlier, a number of variables (age, marital status, mental health treatment, health insurance coverage, opportunity to buy drugs, and number of close friends) were not significant for any of the ethnic subgroups studied. However, rather than removing them from the model, future research should first attempt to validate the lack of association between these concepts and alcohol consumption and/or utilize better measures of the concepts.

In particular need of further development are concepts within the protective domains. Although the study of factors other than individual risk in regard to prenatal alcohol consumption is rather limited, only one individual protective factor (spirituality for Black pregnant females) and one social/environmental risk factor (friends who get drunk weekly for Hispanic pregnant females) emerged as significant. The lack of significant findings on social/environmental risk factors and both domains of protective factors illustrates that much work remains to be done in identifying familial, social, and community-level variables that appear to promote alcohol use during pregnancy, as well as those factors, both individual and social/environmental, that may serve to deter women from drinking during pregnancy. Perhaps qualitative studies, possibly through ethnic-specific focus groups, would yield valuable initial insight into some of these factors.

Studies in the future might also consider examining patterns of prenatal alcohol use in light of other behavioral factors. For example, determining whether having a planned pregnancy significantly reduces drinking, especially during the first trimester, would be of value, as would whether other behaviors such as the use of folic acid are related to a reduction in alcohol use during pregnancy.

Future research on this issue also calls for more intensive study of the predictors associated with prenatal alcohol use among individuals that have documented drinking problems prior to pregnancy. Since binge and heavy

drinking are clearly linked with an increased risk for FAS (Stratton, Howe, & Battaglia, 1996), discovering any risk or protective factors that are unique to these individuals could serve to inform more effective intervention strategies.

Finally, because the use of nationally representative data is appealing for reasons of generalizability, researchers should encourage those entities and organizations that conduct large-scale surveys to consider including additional questions that would appropriately measure concepts that could not be included in this study (e.g., personal competency, reproductive history, positive home environment) or were possibly measured inadequately. Encouraging incorporation of appropriate theory-driven measures is important since data from surveys such as the National Survey on Drug Use and Health serve as an excellent data source for researchers and provide the opportunity for trend tracking.

Implications for Theory Development

Results of this study certainly reinforce findings from previous research that has documented certain risk factors, particularly those at the individual level, are clearly linked with drinking during pregnancy and have important implications for practice with childbearing aged women. However, other findings were not as clear and therefore, incorporating better conceptual measures also has the potential for improving the strength of theoretical and conceptual models used in this type of research.

Results of current ethnic-specific analyses illustrate that the Risk-Protective Model of Prenatal Alcohol Consumption appears to have varying utility for predicting drinking during pregnancy. The proportion of recent drinking that was explained varied substantially by ethnic group--7% among White respondents, 26% among Hispanic respondents, and 33% among Black respondents. It would appear, based on these findings, that the conceptual model developed for this study may be much better suited for the two ethnic minority groups included in this study--e.g. Hispanics and Blacks.

Because of the inconsistent explanatory power of current findings, some might suggest that the Risk-Protective Model is not sufficiently useful for examining alcohol use during pregnancy. It is actually this variability or inconsistency that highlights the critical need to continue testing and refining ethnic-specific conceptual models of prenatal alcohol consumption, such as the Risk-Protective Model. Furthermore, results of present analyses indicate that the domains in the Risk-Protective Model are likely useful, but that the important variables within each domain are likely different for females from different ethnic backgrounds.

Theory-based research on alcohol consumption during pregnancy is extremely limited, and despite inconsistency in some findings, the results can not only serve as a springboard for the continued development of research in this arena, but can begin to fill the gap in the knowledge base on this important public

health issue--e.g. what factors deter at-risk pregnant females from consuming alcohol during pregnancy.

One strength of this study is that it is one of the first systematic, quantitative attempts to examine what factors may be influential in deterring women from drinking alcohol while pregnant. Although only one such variable emerged as significant (spirituality among Black females), it seems reasonable that other factors not identified in this study that function in similar capacities since not all women who are drinkers prior to conception continue to do so during pregnancy.

Improved conceptual models of prenatal alcohol consumption, such as the one proposed by this study, are needed to further explain a behavior that can have such devastating consequences. With a better comprehension of the determinants of drinking during pregnancy, more effective prevention and intervention efforts will be created.

Implications for Practice

Findings from this research also have a number of implications for those practicing with childbearing aged females. The following implications seem particularly applicable to practitioners in health care settings, including social workers, nurses, and physicians, since only one-third of obstetric patients are screened for alcohol use (Stratton et al., 1996). Given that educating all childbearing aged females on the risks associated with drinking during pregnancy

is not likely to happen, results from this study can help inform targeted screening efforts.

There is consistent evidence that women who drink alcohol while pregnant are also cigarette smokers (Astley, Bailey, Talbot, & Clarren, 2000; Gladstone & Levy, 1997; National Institute on Drug Use, 1995) and findings from this study provide additional evidence to support this contention. In fact, cigarette smoking emerged as the only predictor to remain significant across all three ethnic subgroups and highlights the necessity to educate cigarette smokers about the potential dangers associated with alcohol use during pregnancy and to screen known pregnant smokers for current alcohol use. This is especially true for Black pregnant females who were over 33 times more likely to drink alcohol if they smoked.

Other than cigarette use, it is crucial for practitioners to realize that predictors of alcohol consumption during pregnancy appear to vary among women of different ethnic backgrounds. The most obvious implication of such findings is that, unless practitioners are able to screen all childbearing aged females, taking a “one-size-fits-all” approach to screening for alcohol use may not be the most effective means of identifying and helping those most at-risk.

Although cigarette smoking was the only significant predictor across all three ethnic subgroups, two other substance use variables were significant across two groups, including illicit drug use. White respondents who used illicit

drugs were over 6 times as likely, and Hispanic respondents 37 times as likely, to consume alcohol than their subgroup counterparts. In fact, illicit drug use was the most influential predictor among both of these subgroups, emphasizing the need for diligent screening for current drinking among White and Hispanic pregnant females with a known history of illicit drug use, as well as for screening for current drug use.

A diagnosis of alcohol abuse was the second most influential predictor among White and Black pregnant females. While it does not seem surprising that individuals with identified alcohol problems would be at greater risk to drink during pregnancy, these findings do highlight the need for additional education and counseling with these individuals prior to, and throughout, pregnancy. A further implication of these findings is that professionals working in alcohol treatment programs should incorporate teaching on the risks of prenatal alcohol consumption with women of childbearing age.

With regard to Hispanic pregnant females, practitioners should also be aware that those who reported the majority of their friends got drunk every week were more likely to report recent drinking. Practitioners should incorporate this information into psychosocial assessments, and be prepared to provide education on the risk associated with drinking during pregnancy. Given that one's social network may play a vital role in whether Hispanic females consume alcohol, professionals such as social workers and nurses should consider

developing pregnancy and pre-pregnancy support groups for Hispanic females, which could serve as a source of positive encouragement and friendships, as well as a venue for education on topics for achieving a healthy pregnancy, including alcohol avoidance.

Trimester of pregnancy emerged as a significant variable among White pregnant females, with those in their first trimester being more likely to consume alcohol than those in their second or third. This makes it particularly important that practitioners not only ask about alcohol use, but also provide education on the risks associated with it, during the first prenatal care visit, if not sooner with this subgroup.

The only variable to emerge as a significant protective factor was spirituality among Black respondents. This finding is consistent with recent literature stating that participation in religious activities may serve in a protective capacity among women of this ethnic group (Collins & McNair, 2003). Armed with this knowledge, professionals should consider assessing spirituality in their Black clients, who are of childbearing age, particularly those with a known history of drinking problems. Furthermore, with continued growth in the number of faith-based organizations delivering social services, many professionals, particularly social workers may find increased opportunities for building upon this strength among Black women.

Finally, findings from this study suggest a paradigm shift on the part of

practitioners. Although much of the literature on this topic encourages professionals to screen and educate females as early in pregnancy as possible, what really may be more beneficial is a change in the definition of "early." This study found that both White and Hispanic women were more likely to drink during the first trimester of pregnancy. Since damage to a developing fetus can occur at any time during pregnancy, ideally all childbearing aged women would be educated about the risks of alcohol use during pregnancy and encouraged to stop drinking *prior* to becoming pregnant. Should practitioners begin adopting a prevention approach in their practice and educating clients before they become pregnant, such a change in focus could potentially reduce, if not eliminate, drinking during pregnancy among some individuals, thereby decreasing the chance of giving birth to an alcohol-affected infant.

Implications for Policy

Recommendations for national and organizational policies also emerge from this research, coupled with findings from other studies. Prior research has demonstrated that a substantial number of women continue to drink during pregnancy. This is occurring despite research demonstrating that the fetus can be damaged at any time during the pregnancy. In addition, no safe threshold for alcohol use during pregnancy has been established.

Universal preventions, such as the alcoholic beverage warning label, reach the greatest number of people. However, a number of studies have shown

that the alcoholic beverage warning label is no longer an effective method for educating the public on the dangers of alcohol use during pregnancy and can no longer be considered a viable method for reducing the number of alcohol-affected births.

From a public health standpoint, these facts suggest the need for a new public awareness campaign. Such an undertaking should not only attempt to educate the public about the dangers of drinking during pregnancy, but should emphasize the importance of cessation of alcohol use during the time a woman is attempting to become pregnant.

At the institutional level, additional implications exist. Eliminating fetal alcohol syndrome and other consequences caused by maternal alcohol use during pregnancy will require a commitment from medical, social service, and other organizations that serve women of childbearing age, since it will take a network of professionals working together to identify those most at-risk for drinking during pregnancy (Stratton et al., 1996). Such organizations should identify the professional groups responsible for identifying women at-risk and adopt policies that incorporate screening for alcohol use into assessments by the identified practitioner groups. Findings from this study, including the importance of coexisting individual risk behaviors such as cigarette smoking and illicit drug use, can help inform screening strategies.

Conclusion

Achieving a substantial reduction in the number of infants born affected by maternal alcohol use will require both more diligent screening efforts and research that better identifies those psychosocial factors that place females most at-risk for drinking while pregnant and those protective factors that potentially serve to discourage this behavior.

This study builds upon prior research, confirming that certain risk factors, including cigarette smoking and illicit drug use, are associated with a greater likelihood of drinking during pregnancy. In addition, this study represents a starting point for the identification of factors that may actually help pregnant females refrain from consuming alcohol. Subsequent research is also needed that further clarifies the most important determinants of drinking during pregnancy among women of various ethnic backgrounds.

Professionals, including social workers, nurses, and physicians, are encouraged to familiarize themselves with the factors associated with prenatal alcohol consumption and incorporate that knowledge in their practices and in policies of the organizations in which they are employed.

Appendix A

The National Survey on Drug Use and Health:

Data Set and Sampling Methods

The Substance Abuse and Mental Health Services Administration (SAMHSA) of the U.S. Department of Health and Human Services (USDHHS) conducts the NSDUH annually. The following description of the data set is taken from the USDHHS, SAMHSA (2002).

The National Survey on Drug Use and Health series measures the prevalence and correlates of drug use in the United States. The surveys are designed to provide quarterly, as well as annual, estimates. Information is provided on the use of illicit drugs, alcohol, and tobacco among members of United States households aged 12 and older. Questions include age at first use as well as lifetime, annual, and past-month usage for the following drug classes: marijuana, cocaine (and crack), hallucinogens, heroin, inhalants, alcohol, tobacco, and nonmedical use of prescription drugs, including pain relievers, tranquilizers, stimulants, and sedatives. The survey covers substance abuse treatment history and perceived need for treatment, and includes questions from the Diagnostic and Statistical Manual (DSM) of Mental Disorders that allow diagnostic criteria to be applied. Respondents are also asked about personal and family income sources and amounts, health care access and coverage, illegal activities and arrest record, problems resulting from the use of drugs, and

needle-sharing. Demographic data include gender, race, age, ethnicity, marital status, educational level, job status, veteran status, and current household composition.

Data for the NSDUH are collected via computer-assisted personal interviews, and audio computer-assisted self-interviews from the civilian, noninstitutionalized population of the United States aged 12 and older, including residents of noninstitutional group quarters such as college dormitories, group homes, shelters, rooming houses, and civilians dwelling on military installations.

The sampling method is multistage area probability sample for each of the 50 states and the District of Columbia. A coordinated five-year sample design was developed for 1999 through 2003. Although there is no overlap with the 1998 sample, the design facilitates overlap in the first-stage units (area segments) between each two successive years in the five-year design. This design increases the precision of estimates in year-to-year trend analysis.

The sample is stratified on multiple levels, beginning with states. Eight states are considered large sample states and contribute approximately 3,600 respondents per state. The remaining states are sampled to yield 900 respondents per state. The second level of stratification divides states into Field Interviewer (FI) Regions. The third level of stratification divides FI regions into area segments consisting of adjacent census blocks. These area segments were used as the primary sampling units. Dwelling units in area segments were listed

in a standardized order and were selected by systematic sampling. Field interviewers visited each sample address to determine dwelling unit eligibility, to list all eligible persons at the address, and to conduct interviews. Persons were selected from the address roster using a handheld computer.

To improve the precision of estimates, the sample allocation process targeted five age groups: 12-17, 18-25, 26 34, 35 49, and 50 and older. The size measures used in selecting the area segments were coordinated with the dwelling unit and person selection process so that a nearly self-weighting sample could be achieved in each of the five age groups. The sample design included approximately equal numbers of persons in the 12-17, 18-25, and 26 and older age groups.

The 2001 file also includes a boosted sample for New York City and the surrounding area to provider greater precision in analysis of the effects of the events of September 11, 2001. The achieved sample for the 2001 NSDUH was 68,929 persons. The public use file has 55,561 records due to a subsampling step used in the disclosure protection procedures. The study yielded a weighted screening response rate of 92 percent and a weighted interview response rate for the Computer Assisted Interview (CAI) of 73 percent.

Appendix B

Original National Survey on Drug Use and Health Variables

Table B-1
"Original NSDUH Variables"

Variable Name	Description	Attributes
ALCMON	Past month alcohol use	0 = Did not use in the past month 1 = Used within the past month
NEWRACE2	Race/Hispanicity	1 = Non-Hispanic White 2 = Non-Hispanic Black/African American 3 = Non-Hispanic Native American/ Alaskan Native 4 = Non-Hispanic Native Hawaiian/Other Pacific Islander 5 = Non-Hispanic Asian 6 = Non-Hispanic more than one race 7 = Hispanic
IRMARIT	Marital status	1 = Married 2 = Widowed 3 = Divorced or separated 4 = Never been married 99 = Respondent is <=14 years
AGE2	Age category	1 = 12 years 2 = 13 years 3 = 14 years 4 = 15 years 5 = 16 years 6 = 17 years 7 = 18 years 8 = 19 years 9 = 20 years 10 = 21 years 11 = 22-23 years 12 = 24-25 years 13 = 26-29 years 14 = 30-34 years 15 = 35-49 years 16 = 50-64 years 17 = 65 years and older
AMHTXREC	Adult received any mental health treatment past yr	1 = Yes 2 = No 3 = Unknown 4 = Aged 12 –17

Table B-1 continued

ABODALC	Alcohol abuse or dependence in the past year	0 = No/unknown 1 = Yes
CIGMON	Past month cigarette use	0 = Did not use in the past month 1 = Used within the past month
SUMMON	Any illicit drug use past month	0 = Did not use within past month 1 = Used within past month
TRIMEST	Current trimester of pregnancy	1 = 1st 3 months of pregnancy 2 = 2nd 3 months of pregnancy 3 = 3rd 3 months of pregnancy 4 = Males/not pregnant females 99 = Unknown
SNRLDCSN (adult)	My religious beliefs influence my decisions	1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree 94 = Don't know 97 = Refused 98 = Blank (no answer) 99 = Legitimate skip
YERLDCSN (youth)	My religious beliefs influence my decisions	1 = Strongly disagree 2 = Disagree 3 = Agree 4 = Strongly agree 94 = Don't know 97 = Refused 98 = Blank (no answer) 99 = Legitimate skip
ANYHLTIN	Covered by any health insurance	1 =Yes 2 = No 94 = Don't know 97 = Refused 98 = Other missing
GOVTPROG	Participated in one or more government assistance programs	1 = Yes 2 = No
SNFDDRNK (adult)	How many friends get drunk at least once a week	1 = None of them 2 = A few of them 3 = Most of them 4 = All of them 94 = Don't know 97 = Refused 98 = Blank (no answer) 99 = Legitimate skip

Table B-1 continued

YESTSDNK (youth)	How many students you know get drunk weekly	1 = None of them 2 = A few of them 3 = Most of them 4 = All of them 94 = Don't know 97 = Refused 98 = Blank (no answer) 99 = Legitimate skip
APPSELDG	Approached by someone selling drugs	1 = No 2 = Yes 99 = Unknown
IRFAMIN3	Total family income	1 = $0 - $9,999 2 = $10,000 - $19,999 3 = $20,000 - $29,999 4 = $30,000 - $39,999 5 = $40,000 - $49,999 6 = $50,000 - $74,999 7 = $75,000 or more
EMPSTAT4	Employment status	1 = Employed full time 2 = Employed part time 3 = Unemployed 4 = Other (including not in labor force) 5 = 12–17 year olds
SNFRCONC	# friends who you share personal issues/concerns with	1 = None 2 = One 3 = 2 or 3 4 = 4 to 5 5 = More than 5 94 = Don't know 97 = Refused 98 = Blank (no answer) 99 = Legitimate skip
BINGEDRK	Binge alcohol use past 30 days	0 = Never/no binge alcohol use 1 = Binge alcohol use
HVYDRK2	Heavy alcohol use past 30 days	0 = Never/no heavy alcohol use 1 = Heavy alcohol use
ALCMDAYS	Number of days used alcohol in the past month	1 = 1-2 days 2 = 3-5 days 3 = 6-19 days 4 = 20-30 days 5 = No past month use

Appendix C

Analyses of 2001 and 2002 Survey Data

Findings from analyses of year-specific data (e.g. 2001 and 2002 NSDUH), conducted prior to combining the two years of data, are presented here.

Weighting Variables

The variable “ANALWT_C”, which represents the final sample weight, was incorporated into analyses. The NSDUH also contains a stratification variable “VESTR,” which is a stratum variance estimation variable. As seen in the frequency distribution, presented in Table C-1, there were very low numbers of cases per stratum.

Table C-1
"Frequency Distribution of # of Cases per Strata"

#Cases per stratum	Frequency 2001	% 2001	Frequency 2002	% 2002
1	293	52.60	316	58.30
2	182	32.68	158	29.15
3	50	8.98	46	8.49
4	24	4.31	16	2.95
5	5	0.90	5	0.92
6	2	0.36	1	0.18
7	0	0.00	0	0.00
8	0	0.00	0	0.00
9	1	0.18	0	0.00

In order to conduct proposed analyses using 2001 NSDUH data, strata with six cases or less were collapsed into one of the seven categories of income (IRFAMIN3) as seen in Table C-2.

Table C-2
"Distribution of Collapsed Cases by Income Level:
2001 NSDUH"

Income Level	Strata with 1 case	Strata with 2 cases	Strata with 3 cases	Strata with 4 cases	Strata with 5 cases	Strata with 6 cases	Total # of cases
< $10,000	40	36	24	11	2	0	113
$10,000 - $19,999	41	60	24	19	4	3	151
$20,000 - $29,999	48	65	24	20	4	2	163
$30,000 - $39,999	46	68	19	11	2	1	147
$40,000 - $49,999	32	44	18	15	5	4	118
$50,000 - $74,999	46	48	22	13	6	1	136
$75,000+	40	43	19	7	2	1	112

In order to conduct proposed analyses using 2002 NSDUH data, strata with five cases or less were collapsed by income (IRFAMIN3) as seen in Table C-3.

Table C-3
"Distribution of Collapsed Cases by Income Level:
2002 NSDUH"

Income Level	Strata with 1 case	Strata with 2 cases	Strata with 3 cases	Strata with 4 cases	Strata with 5 cases	Total # of cases
< $10,000	38	34	20	12	1	105
$10,000 - $19,999	56	55	24	16	2	153
$20,000 - $29,999	46	55	22	10	5	138
$30,000 - $39,999	45	46	17	6	1	115
$40,000 - $49,999	41	41	18	4	3	107
$50,000 - $74,999	53	57	22	8	10	150
$75,000+	37	28	15	8	3	91

Analysis of 2001 NSDUH Pregnant Females Cohort

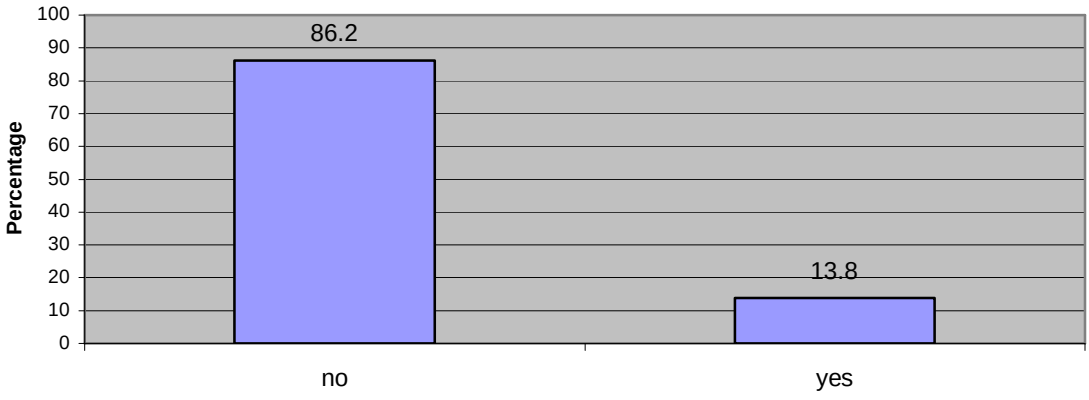
Descriptive analyses of the 2001 cohort of pregnant females was conducted using all variables in the Risk-Protective Model of Prenatal Alcohol Consumption, as well as additional variables to describe drinking characteristics of the cohort. Bivariate comparisons of pregnant females who reported recent alcohol use and those who did not were conducted using these factors. Initial testing of the Risk-Protective Model of Prenatal Alcohol Consumption was then conducted.

Descriptive Analysis

Prevalence of Prenatal Alcohol Use

One hundred eleven (111), or 13.82% (SE 1.74), of the 949 pregnant females in the 2001 NSDUH reported alcohol consumption in the past month.

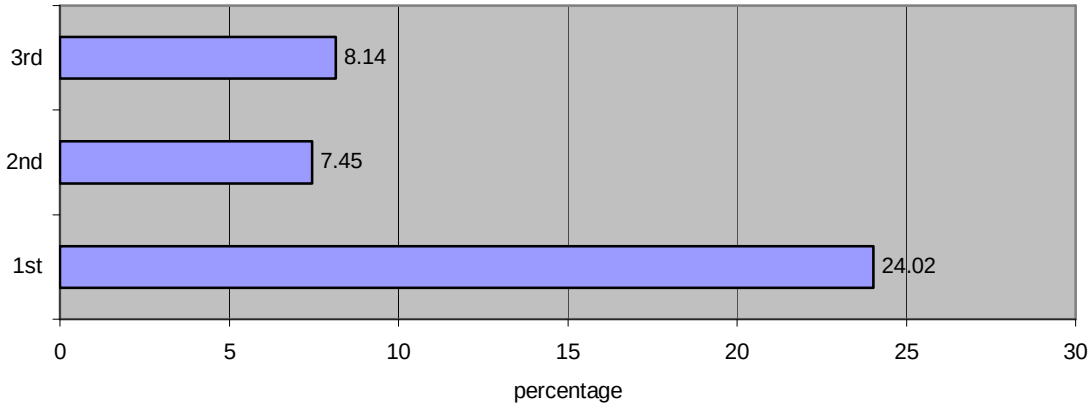
Figure C-1
Alcohol Use among 2001 Pregnant Females



Trimester of Pregnancy

Among 2001 pregnant females, 299 (35.04%, SE 2.39) were in their first trimester of pregnancy, 339 (33.57%, SE 2.22) in their second, and 303 (31.39%, SE 2.26) in their last. Figure C-2 illustrates the rate of alcohol consumption was highest among pregnant females in their first trimester of pregnancy (24.02%, SE 3.64) compared to pregnant females in their second (7.45%, SE 2.22) or third (8.14%, SE 2.72) trimester.

Figure C-2
Rates of Prenatal Alcohol Use by Trimester:
2001 Pregnant Females

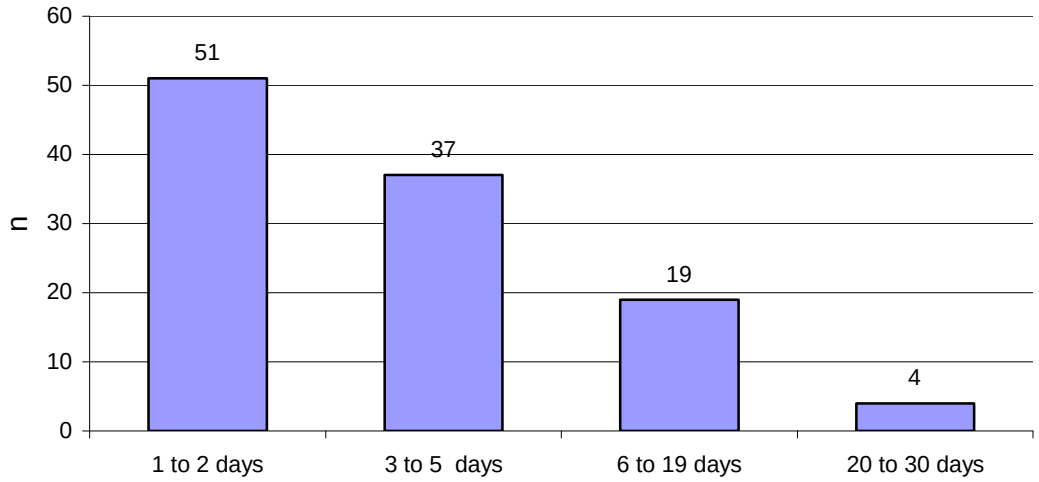


Results of a goodness of fit chi square test indicated a significant difference in trimester of pregnancy between pregnant women who reported recent alcohol use and those who had not (chi square (2) = 48.54, p = .0001).

Number of days drank in past month (ALCMDAYS)

Figure C-3 shows most pregnant females who reported drinking in the past month drank on 1-2 days.

Figure C-3
"Number of Days Drank in Past Month:
2001 Pregnant Females"



Heavy Drinking

Heavy drinking, defined as drinking five or more drinks on the same occasion on each of 5 or more days in the past 30 days, was reported by less than 1% of the 2001 cohort (0.97, SE 0.40). As expected, rates of recent alcohol use were much higher among pregnant females who reported heavy drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (12.68%, SE 1.73), and results of a chi square goodness of fit test indicated a significant difference between pregnant women on this variable (chi square (1) = 57.90, p = .0000).

Binge Drinking (BINGEDRK)

Binge drinking, defined as drinking five or more drinks on the same occasion on at least 1 day in the past 30 days, was reported by 44 (4.58%, SE

1.02) pregnant females in the 2001 cohort (note that heavy drinkers are also counted as binge drinkers). As expected, the alcohol use rate was much higher among pregnant females who reported binge drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (9.68%, SE 1.56), and results of a chi square goodness of fit test indicated a significant difference between pregnant women on this variable (chi square (1) = 284.06, p < .0000).

Domain 1: Individual Risk Factors

Ethnicity (NEWRACE2)

Table C-4 contains the ethnic distribution of all pregnant females in the 2001 cohort, as well as alcohol use rates for each group. Non-Hispanic pregnant females who were of more than one race reported the highest use rate (48.1%), followed by Non-Hispanic Native American/Alaskan Natives (16.1%) and Non-Hispanic White respondents (16.1)%. The rates of all three of these groups were above the average rate reported by the whole cohort (13.8%).

The lowest rates of alcohol consumption were reported by Non Hispanic Asian (5.9%) and Non-Hispanic Native Hawaiian pregnant females who reported no recent alcohol use.

Table C-4
"Ethnic Comparison of Rates of Prenatal Alcohol Consumption:
2001 Pregnant Females"

Ethnic Group	Group n (N = 949)	Group % (SE) of 2001 Cohort	n of Group Reporting Use (n = 111)	% (SE) Recent Use within Group
Non-Hispanic White	568	58.25 (2.40)	75	16.06 (2.38)
Hispanic	165	17.59 (1.92)	13	9.79 (3.28)
Non-Hispanic Black/African American	137	15.15 (1.81)	15	9.76 (3.60)
Non-Hispanic Asian	36	6.71 (1.36)	2	5.87 (4.58)
Non-Hispanic Native American/Alaskan Native	20	0.59 (0.20)	2	16.14 (13.12)
Non-Hispanic, more than one race	19	1.61 (0.73)	4	48.14 (23.31)
Non-Hispanic Native Hawaiian/Other Pacific Islander	4	0.10 (0.05)	0	0.00 (0.0)

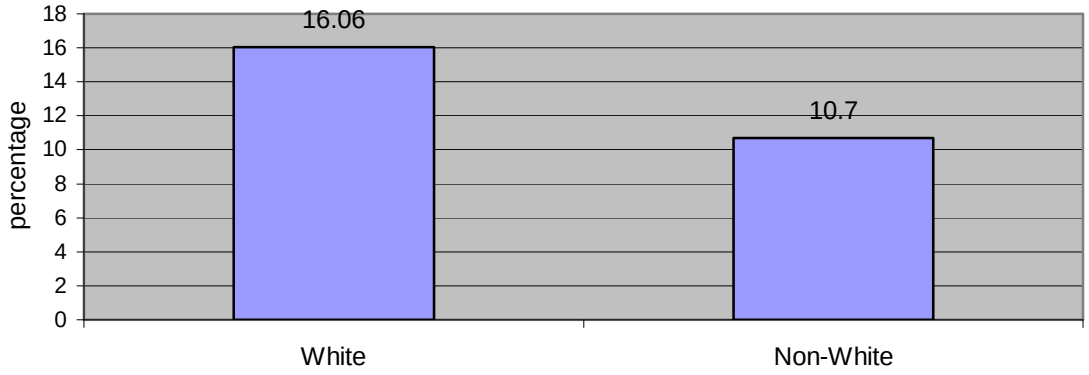
Results of a chi square goodness of fit test of ethnic differences between pregnant females who had recently consumed alcohol and those who had not was significant (chi-square (6) = 25.29, p = .0465).

Ethnicity (ETHNIC - dichotomous)

Due to the small numbers of females reporting alcohol use in groups other than Non-Hispanic White, this variable was recoded into a dichotomous variable of White (n = 568) versus non-White (n = 381) to allow preliminary examination of ethnic differences in prenatal alcohol use. As seen in Figure C-4, White pregnant

females had higher rates of use (16.06%, SE 2.38) than Non-White pregnant females (10.70%, SE 2.50), but results of a chi square goodness of fit test were not significant (chi-square (1) = 5.56, p = .1357).

Figure C-4
Rates of Prenatal Alcohol Use by Ethnicity:
2001 Pregnant Females



Age (NEWAGE)

Table C-5 shows that older respondents had higher rates of prenatal alcohol use (16.3%) compared to younger respondents (10.2%), and the difference between pregnant females who reported recent alcohol use and those that did not was significant (chi-square (1) = 7.20, p = .0337).

Table C-5
"Rates of Prenatal Alcohol use by Age:
2001 Pregnant Females "

	Alcohol Use N = 111	Alcohol Use % (SE)
< 26 years (n = 679)	67	10.23 (1.41)
≥ 26 years (n = 270)	44	16.34 (2.79)

Marital Status (MARRIED)

As seen in Table C-6, 15.5% of unmarried pregnant females reported recent alcohol use compared to 13.0% of married pregnant females, but there was no significant difference in marital status between pregnant females who reported recent alcohol use and those that did not (chi-square (1) = 1.11, p = .4803).

Table C-6
"Rates of Prenatal Alcohol Use by Marital Status:
2001 Pregnant Females "

	Alcohol Use N = 111	Alcohol Use % (SE)
Married (n = 517)	53	13.00 (2.16)
Unmarried (n = 432)	58	15.51 (2.90)

Mental health problems (ADMHTX)

Among 2001pregnant adult females, 96 (9.09%, SE 1.31) indicated they had received mental health treatment in the past year. Pregnant females who reported receiving such treatment had higher alcohol use rates (31.35%, SE 7.96) than those who did not receive mental health treatment (12.61%, SE 1.80). Results of a goodness of fit chi square test indicated a significant difference on this indicator of mental health problems between adult pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 20.49, p = .0030).

Alcohol abuse or dependence (ABODALC)

Sixty-two, or 5.52% (SE 1.16), of pregnant females in the 2001 survey indicated a diagnosis of alcohol abuse or dependency in the past year. Pregnant females who reported either diagnosis had higher rates of alcohol consumption (48.49%, SE 10.99) compared to those without either diagnosis (11.80%, SE 1.60). There was a significant difference on this indicator between pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 55.93, p = .0000).

Cigarette use (CIGMON)

As seen in Table C-7, prenatal alcohol consumption was much higher among respondents reporting cigarette use in the past month (28.5%) compared to those who did not smoke (10.5%). Results of a goodness of fit chi square test indicated a significant difference in smoking status between pregnant females who consumed alcohol in the past month and those who had not (chi square (1) = 38.49, p = .0000).

Table C-7
"Rates of Prenatal Alcohol Use by Cigarette Use:
2001 Pregnant Females "

	Alcohol Use n = 111	Alcohol Use % (SE)
Cigarette smoker (n = 218)	52	28.52 (5.00)
Non-smoker (n = 731)	59	10.53 (1.74)

Illicit drug use (SUMMON)

Less than 5% of pregnant females in the 2001 survey reported using illicit drugs in the past month. As seen in Table C-8, those who reported recent drug use had higher rates of alcohol use (42.1%) compared to those who did not use drugs (12.4%). There was a significant difference between pregnant females who consumed alcohol in the past month and those who had not on this indicator (chi square (1) = 31.21, p = .0000).

Table C-8
"Rates of Prenatal Alcohol Use by Illicit Drug Use:
2001 Pregnant Females "

	Alcohol Use N = 111	Alcohol Use % (SE)
Used drugs (n = 58)	21	42.10 (8.87)
No drug use (n = 891)	90	12.44 (1.75)

Domain 2: Social/Environmental Risk Factors

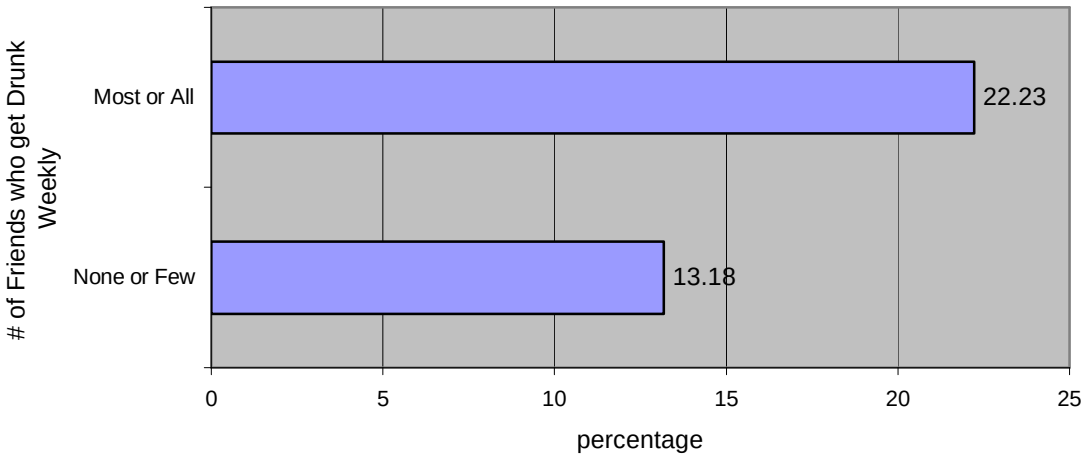
Government program participation (GOVTPROG)

Almost 20% (n = 230) of pregnant females indicated they were on at least one government assistance program. Pregnant females who reported received such assistance had slightly higher alcohol use rates (14.92%, SE 4.17) than pregnant females that did not (13.55%, SE 1.92). There was no significant difference in government assistance participation between pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 0.24, p = .7595).

Friends who get drunk at least once a week (DRKFRDS)

Ninety-eight (98), or 6.38% (SE 0.96), of the 2001 cohort reported that most or all of their friends got drunk at least once a week. As seen in Figure C-5, pregnant females who reported that most or all of their friends get drunk weekly had higher rates of alcohol use (22.2%) than pregnant females who reported that none of few of their friends did (13.2%), but results of a goodness of fit chi square test indicated that the difference between pregnant females who reported recent alcohol consumption and those who did not was not significant (chi square (1) = 3.77, p = .0665).

Figure C-5
Rates of Prenatal Alcohol Use by Friends:
2001 Pregnant Females



Opportunity to buy illegal drugs (APPSELDG)

Seventy-six (76) of the pregnant females in the 2001 survey indicated

someone selling drugs had approached them in the past month. Pregnant females who indicated they had a recent opportunity to buy drugs reported higher rates of alcohol use 21.60% (SE 6.11) than pregnant females who reported they had no such opportunity (13.35%, SE 1.83), but there was no significant difference between respondents who drank alcohol in the past month and those who had not on this indicator (chi square (1) = 3.46, p = .1355).

Domain 3: Individual Protective Factors

Spirituality (SPIRITLY)

Pregnant females who indicated that religious beliefs influenced their decisions in life (n = 597) had rates of alcohol consumption (13.99%, SE 2.19) similar to pregnant females indicating that religion was not important (n = 328) in their life (13.83%, SE 2.87). Results of a goodness of fit chi square test indicated no significant difference on this measure of spirituality between pregnant women who reported recent alcohol consumption and those who did not (chi-square (1) = 0.004, p = .9644)

Insurance coverage (ANYHLTIN)

Among pregnant females in the 2001 survey, 101 indicated they did not have health insurance. Similar rates of alcohol use were seen among pregnant females who had health insurance (13.73%, 1.86) and those who did not (13.93%, 4.88). There was no significant difference in insurance coverage status between pregnant women who drank alcohol in the past month and those who

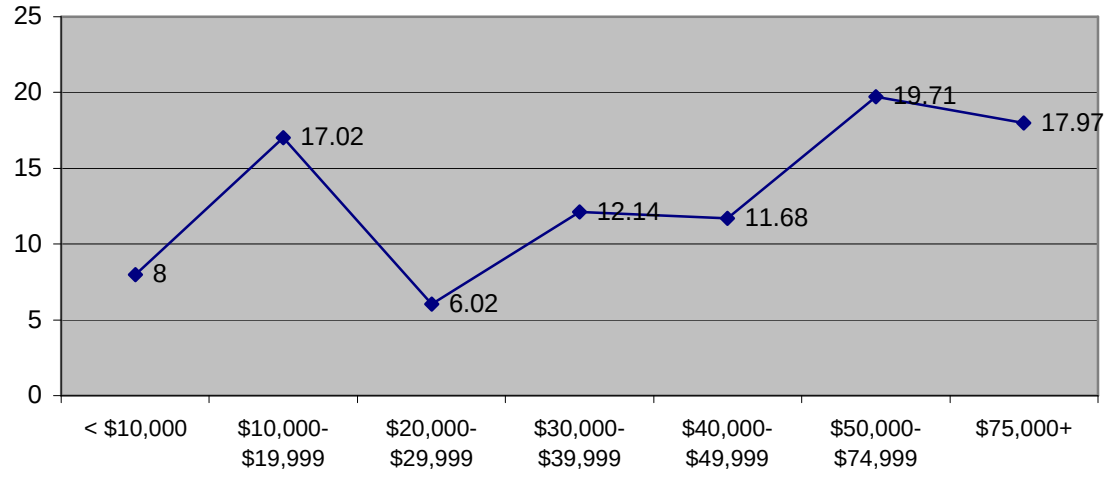
did not (chi square (1) = 0.003, p = .9697).

Domain 4: Social/Environmental Protective Factors

Income (IRFAMIN3)

As seen in Figure C-6, pregnant females with annual household income between $50,000-74,999 had the highest rates of recent alcohol use (19.71%, SE 5.36), followed by those with incomes above $75,000 (17.97%, SE 5.08) and those whose income fell between $10,000-$19,999 (17.02%, SE 5.25). Pregnant females with the lowest alcohol consumption rates (6.02%, SE 1.85) had incomes between $20,000-$29,999.

Figure C-6
Rates of Prenatal Alcohol Use by Income
2001 Pregnant Females



Results of a goodness of fit chi square test indicated no significant difference in annual household income between pregnant females who reported recent alcohol use and those that did not (chi-square (6) = 18.38, p = .1693).

Employment Status (EMPLYD)

As seen in Table C-9 pregnant females who reported recent alcohol consumption were more likely to be employed (full or part time) than unemployed, but there was no significant difference in employment status between pregnant females who had recently consumed alcohol and those who had not (chi square (1) = 4.10, p = .2009).

Table C-9
"Rates of Prenatal Alcohol Consumption by Employment Status
2001 Pregnant Females"

	Alcohol Use n = 111	Alcohol Use % (SE)
Employed (n = 507)	73	15.84 (2.42)
Unemployed (n = 442)	38	11.27 (2.50)

Supportive friends (SNFCONC)

Table C-10 shows rates of alcohol use were highest among pregnant females who report they had no close friends with whom they shared personal issues and concerns (18.2%), followed by those who had six or more close friends (16.3%). The lowest rates of alcohol use were seen among respondents with four or five close friends (10.5%) or a single close friend (10.9%). Results of a goodness of fit chi square test indicated no significant difference on this indicator between pregnant women who report recent alcohol consumption and those who did not (chi square (4) 4.94, p = .7084).

Table C-10
"Number of Close Friends by Consumption Status
2001 Pregnant Females"

# Friends	Alcohol Use % (SE)
None	18.21 (5.81)
1	10.88 (2.99)
2 or 3	15.07 (2.75)
4 or 5	10.54 (5.11)
More than 5	16.30 (5.50)

Descriptive Summary of 2001 Cohort

Pregnant females in the 2001 NSDUH were predominantly Non-Hispanic White (58%), married (67%), and employed (56%). The vast majority of pregnant females reported having health insurance (91%) and that spirituality was an important influence in their life (73%).

The overall alcohol use rate among 2001 NSDUH pregnant females was 14%, with the majority of respondents indicating they drank 1 to 2 days in the past month. During the month prior to the survey, 4% to 5% of pregnant females engaged in binge drinking and illicit drug use, 18% smoked cigarettes, and 7% were approached by someone selling illegal drugs.

Pregnant females who reported alcohol consumption within the past month were compared to those who did not drink any alcohol on a number of predictors. The findings from these comparisons are summarized in Table C-11.

Table C-11
"Summary of Bivariate Comparisons:
2001 Pregnant Females"

Characteristic	Chi square value	p value
Domain 1: Individual Risk Factors		
Ethnicity, 7 categories	25.2863	p = .0465*
Ethnicity, White vs. Non-White	5.5647	p = .1357
Age	7.2030	p = .0337*
Marital status	1.1098	p = .4895
Mental health problems	20.4855	p = .0030**
Alcohol abuse or dependence	55.9280	p = .0000***
Cigarette use	38.4885	p = .0000***
Illicit drug use	31.2079	p = .0000***
Domain 2: Social Environmental Risk Factors		
Government program participation	0.2366	p = .7595
Friends who get drunk regularly	3.7738	p = .0665
Opportunity to buy illegal drugs	3.4561	p = .1355
Domain 3: Individual Protective Factors		
Spirituality	.0040	p = .9644
Health insurance coverage	.0025	p = .9697
Domain 4: Social/Environmental Protective Factors		
Income	18.3776	p = .1693
Employment status	4.1054	p = .2009
Close friends	4.9376	p = .7084

* significant at .05 level **significant at .01 level ***significant at .001 level

There was no significant difference between pregnant females who consumed alcohol and those who did not on any protective factors, but significant

differences were detected on a number of risk factors. There was a significant difference between pregnant women and consumption status on the non-collapsed (7 category) ethnicity variable, but that comparison was not detected once ethnicity was dichotomized to White vs. Non-White. Significant differences were also seen on:

- age, with those 26 years and older reporting higher rates of use
- alcohol abuse or dependence, with those having either diagnosis reporting higher rates of use
- cigarette smoking, with smokers reporting higher rates of use
- illicit drug use, with drug users reporting higher rates of use, and
- trimester, with those in their first trimester reporting higher use rates.

There were also significant differences between respondents who reported recent drinking and those who did not on binge drinking and heavy drinking. Because binge drinking and heavy drinking in the past month would perfectly predict the dependent variable (ALCMON – any drinking in the past month), these variables were not added to the model. However, trimester, which was not originally identified as a possible predictor, was added to the model after being recoded into a dichotomous variable (1^{st} vs. 2^{nd} or 3^{rd} trimester).

Testing the Risk-Protective Model: 2001 NSDUH

All Pregnant Females

Results of regression analysis with the 2001 cohort are seen in Table C-

12. The model was statistically significant at each step, but only individual risk factors were statistically significant in the final model. The addition of individual protective (Block 2) and social/environmental risk (Block 3) factors to the regression analysis had little impact on the model R^2 value, while the addition of social/environmental protective factors increased the model R^2 value by almost 3%. Variables in the full model explained approximately 20% of prenatal alcohol consumption, making the strength of the relationship between the independent variables and the dependent moderate.

Table C-12
"2001 Logistic Regression Findings:
All Pregnant Females"

	Domain 1	Domains 1, 2	Domains 1, 2, 3	Full Model
R^2	.1708	.1663	.1689	.1977
Δ in R^2	N/A	-.0045	+ .0026	+ .0288
p of model	p < .001	P < .001	p < .001	p < .001
Significant Coefficients p < .05	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	NEWAGE ABODALC CIGMON SUMMON NEWTRIM
# of cases	859	838	837	819

Significant Predictors among 2001 Pregnant Females

Additional information on those variables that remained statistically significant in the full model, all of which were individual risk factors, are seen in Table C-13. The variable ABODALC, which indicated whether or not a

respondent had a diagnosis of alcohol abuse or dependence in the past year, was the most influential predictor among all 2001 pregnant females, with those respondents over 6 times as likely to consume alcohol during pregnancy.

The next most influential predictor was NEWTRIM, with pregnant females in the first trimester of pregnancy almost 4 times as likely to drink compared to women in their second or third trimester. Pregnant females that used illicit drugs (SUMMON) were over 3 times as likely to use alcohol than non drug-users. Compared to respondents less than 26 years and non-smokers, those that were at least 26 years old (NEWAGE) or smoked cigarettes (CIGMON) during the past month were twice as likely to engage in prenatal alcohol consumption.

Table C-13
"2001 Statistically Significant Predictors:
All Pregnant Females"

	B	SE	95% CI	T	P	Odds Ratio
Individual Risk:						
NEWAGE	.74	.316	.119 1.360	2.34	.020	2.10
ABODALC	1.83	.658	.542 3.126	2.79	.005	6.26
CIGMON	.77	.348	.091 1.457	2.22	.026	2.17
SUMMON	1.19	.574	.065 2.317	2.08	.038	3.29
NEWTRIM	1.38	.331	.728 2.027	4.16	.000	3.97
Individual Protective:						
None	---	---	---	---	---	---
Social/Env Risk:						
None	---	---	---	---	---	---
Social Env Protective:						
None	---	---	---	---	---	---

Ethnic Comparisons of 2001 Pregnant Females

Table C-14 contains findings from regression analyses of all pregnant females and the subgroups of White and Non-White respondents. The strength of the model of White respondents was similar to that of the full cohort, with both explaining approximately 20% of prenatal alcohol use. However, the R^2 of the model with the subgroup Non-White pregnant females was much stronger, with over 36% of the variance in the dependent variable explained.

Only two predictors (ABODALC and NEWTRIM) were statistically significant among 2001 White pregnant females. Both variables were individual risk factors and were also significant among the larger 2001 cohort.

Three individual risk factor variables (ABODALC, CIGMON, SUMMON) that were significant in the full model were also significant for the subgroup of Non-White respondents. In addition, one individual risk factor (ADMHTX – whether an adult had received mental health treatment in the past year) and one social/environmental risk factor (DRKFRDS – number of friends who get drunk every week) were also significant among 2001 Non-White respondents, although they were not significant among the larger 2001 cohort.

Table C-14
"2001 Logistic Regression Findings:
Ethnic Comparisons"

	All Pregnant Females	White Pregnant Females	Non-White Pregnant Females
R^2	.1977	.1958	.3633
P of model	p < .001	P < .001	p < .001
Significant Coefficients p ≤ .05	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	ABODALC NEWTRIM	ADMHTX ABODALC CIGMON SUMMON DRKFRDS
# of cases	819	508	311

Significant Predictors among 2001 White Pregnant Females

Table C-15 shows that ABODALC (a diagnosis of alcohol abuse or dependence in the past year) was the most influential predictor among White pregnant females. Respondents with either diagnosis were over 11 times as likely to drink alcohol than those without either diagnosis and those in their first trimester of pregnancy were more than 5 times as likely to engage in prenatal alcohol consumption compared to those in their second or third trimester.

Table C-15
"2001 Statistically Significant Predictors:
White Pregnant Females"

	B	SE	95% CI	t	p	Odds Ratio
Individual Risk:						
ABODALC	2.45	.801	.873 4.020	3.06	.002	11.55
NEWTRIM	1.68	.405	.882 2.472	4.14	.000	5.35
Individual Protective:						
None	---	---	---	---	---	---
Social/Env Risk:						
None	---	---	---	---	---	---
Social Env Protective:						
None	---	---	---	---	---	---

Significant Predictors among 2001 Non-White Pregnant Females

As seen in Table C-16, ADMHTX was the most influential predictor among Non-White pregnant females, with those who had received mental health treatment in the past year 10 ½ times more likely than those who had not to drink while pregnant. Respondents who had used illicit drugs in the past month were 7 times more likely to consume alcohol during pregnancy than non drug-users and those who had been diagnosed with alcohol abuse or dependence were 6 ½ times more likely to engage in prenatal alcohol consumption than those who had not. Respondents who reported that most or all of their friends got drunk regularly were 6 times more likely to drink during pregnancy than those who indicated that none or few of their friends engaged in such behavior. Cigarette smokers were almost 4 times as likely to drink during pregnancy than non-smokers.

Table C-16
"2001 Statistically Significant Predictors:
Non-White Pregnant Females"

	B	SE	95% CI	T	p	Odds Ratio
Individual Risk:						
ADMHTX	2.35	.9057	.568 4.133	2.60	.010	10.49
ABODALC	1.89	.853	.208 3.564	2.21	.028	6.59
CIGMON	1.35	.643	.0898 2.620	2.11	.036	3.88
SUMMON	1.95	1.019	-.0539 3.957	1.91	.056	7.03
Individual Protective:						
None	---	---	---	---	---	---
Social/Env Risk:						
DRKFRDS	1.87	.936	.0292 3.715	2.00	.046	6.50
Social Env Protective:						
None	---	---	---	---	---	---

Analysis of 2002 NSDUH Pregnant Females Cohort

Descriptive analyses of the 2002 cohort of pregnant females was conducted using all variables in the Risk-Protective Model of Prenatal Alcohol Consumption, as well as additional variables to describe drinking characteristics of the cohort. Bivariate comparisons of pregnant females who reported recent alcohol use and those who did not were conducted using these factors. The Risk-Protective Model of Prenatal Alcohol Consumption was then tested and findings compared to those using the 2001 data.

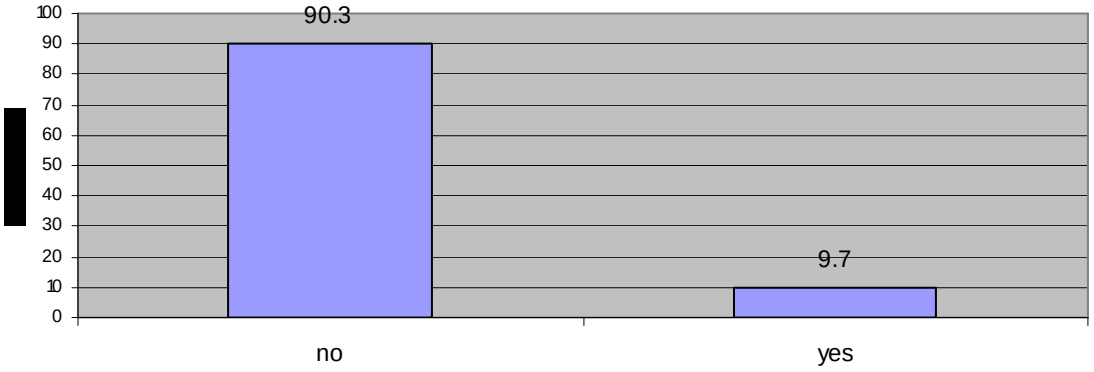
Descriptive Analysis

Prevalence of Prenatal Alcohol Use

One hundred-one (101) of the 865 pregnant females in the 2002 NSDUH,

or 9.74% (SE 1.35), reported alcohol consumption in the past month.

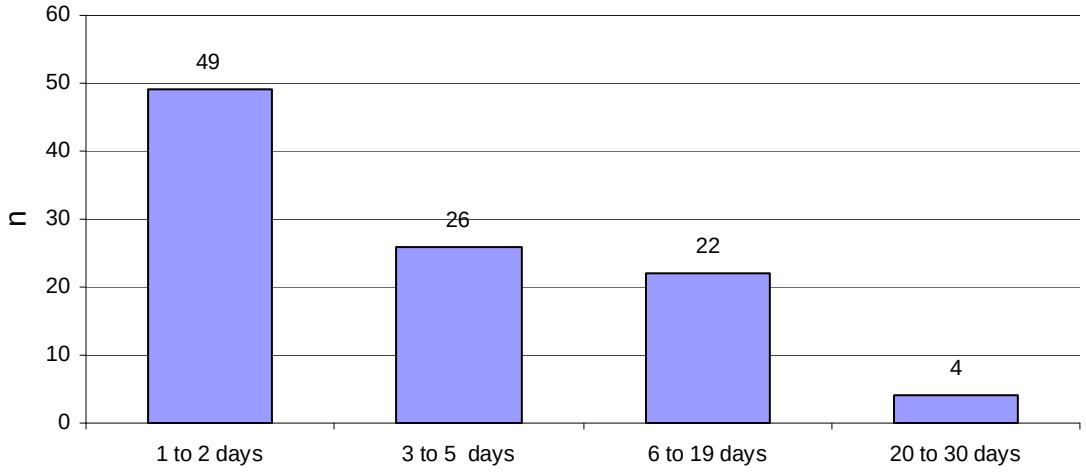
Figure C-7
Alcohol Use among 2002 Pregnant Females



Number of days drank in past month (ALCMDAYS)

Figure C-8 shows most pregnant females who reported drinking in the past month drank on 1-2 days.

Figure C-8
"Number of Days Drank in Past Month:
2002 Pregnant Females"



Heavy Drinking (HVYDRK2)

Heavy drinking, defined as drinking five or more drinks on the same occasion on each of 5 or more days in the past 30 days, was reported by less than 1% of the 2002 cohort (0.82, SE 0.37). As expected, rates of recent alcohol use were much higher among pregnant females who reported heavy drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (9.00%, SE 1.32), and results of a chi square goodness of fit test indicated a significant difference between pregnant women on this variable (chi square (1) = 66.19, p = .0000).

Binge Drinking (BINGEDRK)

Binge drinking, defined as drinking five or more drinks on the same occasion on at least 1 day in the past 30 days, was reported by 46 (3.47%, SE 0.67) pregnant females in the 2002 cohort (note that heavy drinkers are also counted as binge drinkers). As expected, the alcohol use rate was much higher among pregnant females who reported binge drinking in the past month (100.00%, SE 0.00) compared to pregnant females who did not (6.50%, SE 1.23), and results of a chi square goodness of fit test indicated a significant difference between pregnant women on this variable (chi square (1) = 288.10, p = .0000).

Domain 1: Individual Risk Factors

Ethnicity (NEWRACE2)

Table C-17 contains the ethnic distribution of all pregnant females in the 2002 cohort, as well as rates of consumption for each group. The highest rates of drinking during pregnancy were reported by Non-Hispanic respondents who were of more than one race (16.3%), Non-Hispanic Native American/Alaskan Natives (15.8%), and Non-Hispanic White respondents (12.1%). The rates of these three groups were above the use rate of the whole cohort (9.7%). No Non-Hispanic Asian or Non-Hispanic Native Hawaiian pregnant females reported recent alcohol use.

Table C-17
"Ethnic Comparison of Rates of Prenatal Alcohol Consumption:
2002 Pregnant Females"

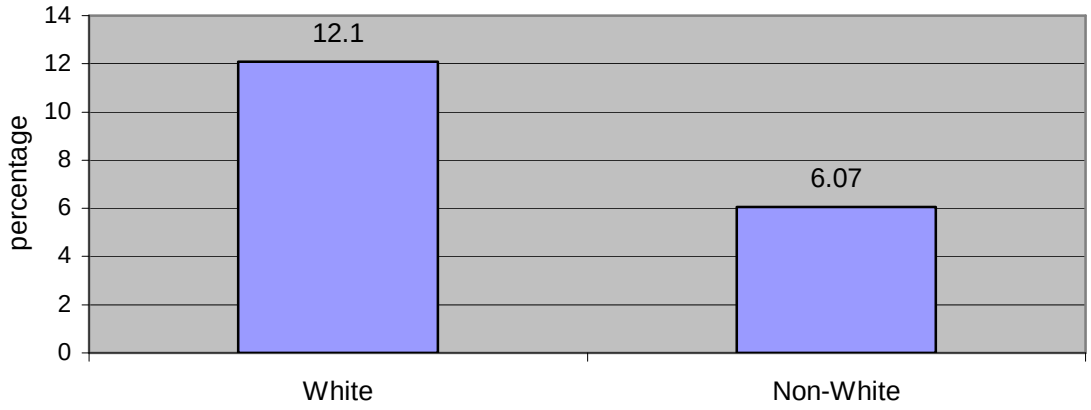
Ethnic Group	Group n (N = 865)	Group % (SE) of 2001 Cohort	n of Group Reporting Use (n = 101)	% (SE) Recent Use within Group
Non-Hispanic White	512	60.94 (2.66)	66	12.10 (2.03)
Hispanic	158	20.61 (2.50)	19	6.27 (1.97)
Non-Hispanic Black/African American	144	12.42 (1.37)	11	5.32 (1.83)
Non-Hispanic Asian	15	3.12 (1.25)	0	0.0 (0.00)
Non-Hispanic Native American/Alaskan Native	10	0.89 (0.46)	1	15.85 (15.47)
Non-Hispanic, more than one race	21	1.69 (0.67)	4	16.31 (9.93)
Non-Hispanic Native Hawaiian/Other Pacific Islander	5	0.25 (0.14)	0	0.00 (0.00)

Results of a chi square goodness of fit test indicated no significant ethnic differences between pregnant females who had recently consumed alcohol and those who had not (chi-square (6) = 12.40, p = .2337).

Ethnicity (ETHNIC - dichotomous)

Due to the small numbers of females reporting alcohol use in groups other than Non-Hispanic White, this variable was recoded into a dichotomous variable of White (n = 512) versus non-White (n = 353), to allow examination of ethnic differences in prenatal alcohol use among 2002 respondents. As seen in Figure C-9, White pregnant females had higher rates of alcohol use (12.10%, SE 2.03) than Non-White pregnant females (6.07%, SE 1.31), and results of a chi square goodness of fit test indicated a significant ethnic difference (White vs. Non-White) between pregnant females who did and did not report alcohol consumption in the past month (chi-square (1) = 8.50, p = .0102).

Figure C-9
Rates of Prenatal Alcohol Use by Ethnicity:
2002 Pregnant Females



Age (NEWAGE)

As seen in Table C-18, younger respondents had higher rates of prenatal alcohol use (10.8%) compared to older respondents (8.9%), but the difference between pregnant females who reported recent alcohol use and those that did not was significant (chi-square (1) = 0.8911, p = .4771).

Table C-18
"Rates of Prenatal Alcohol use by Age:
2002 Pregnant Females "

	Alcohol Use n = 101	Alcohol Use % (SE)
< 26 years (n = 649)	75	10.80 (1.42)
≥ 26 years (n = 216)	26	8.89 (2.15)

Marital Status (MARRIED)

As seen in Table C-19, 11.9% of unmarried pregnant females reported recent alcohol use compared to 8.5% of married pregnant females, but there was no significant difference in marital status between pregnant females who reported recent alcohol use and those that did not (chi-square (1) = 2.48, p = .2159).

Table C-19
"Rates of Prenatal Alcohol Use by Marital Status:
2002 Pregnant Females "

	Alcohol Use n = 101	Alcohol Use % (SE)
Married (n = 432)	39	8.55 (1.83)
Unmarried (n = 433)	62	11.86 (1.87)

Mental health problems (ADMHTX)

Among pregnant adult females, 107 (11.52%, SE 1.69) indicated they had received mental health treatment in the past year. Pregnant females who reported receiving such treatment had similar rates of prenatal alcohol consumption (8.94%, SE 3.81) compared to those who did not receive mental health treatment (9.68%, SE 1.49). Results of a goodness of fit chi square test indicated no significant difference on this indicator of mental health problems between adult pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 0.05, p = .8611).

Alcohol abuse or dependence (ABODALC)

Among 2002 pregnant females, 70 (6.942%, SE 1.31) indicated a diagnosis of alcohol abuse or dependence in the past year. Pregnant females who reported such a diagnosis had higher use rates (24.26%, SE 6.87) compared to those without either diagnosis (8.66%, SE 1.36). There was a significant difference on this indicator between pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 15.45, p = .0019).

Cigarette use (CIGMON)

As seen in Table C-20, rates of alcohol consumption were much higher among pregnant females reporting cigarette use in the past month (23.7%) compared to those who did not smoke (6.8%). Results of a goodness of fit chi

square test indicated a significant difference in smoking status between pregnant females who consumed alcohol in the past month and those who had not (chi square (1) = 40.81, p = .0000).

Table C-20
"Rates of Prenatal Alcohol Use by Cigarette Use:
2002 Pregnant Females "

	Alcohol Use n = 101	Alcohol Use % (SE)
Cigarette smoker (n = 206)	48	23.68 (4.00)
Non-smoker (n = 659)	53	6.77 (1.36)

Illicit drug use (SUMMON)

Less than 4% of pregnant females in the 2002 survey reported using illicit drugs in the past month. Table C-21 illustrates that those who reported illicit drug use had higher rates of prenatal alcohol consumption (49.4%) compared to those who did not use drugs (8.31%). There was a significant difference between pregnant females who consumed alcohol in the past month and those who had not on this indicator (chi square (1) = 55.91, p = .0000).

Table C-21
"Rates of Prenatal Alcohol Use by Illicit Drug Use:
2002 Pregnant Females "

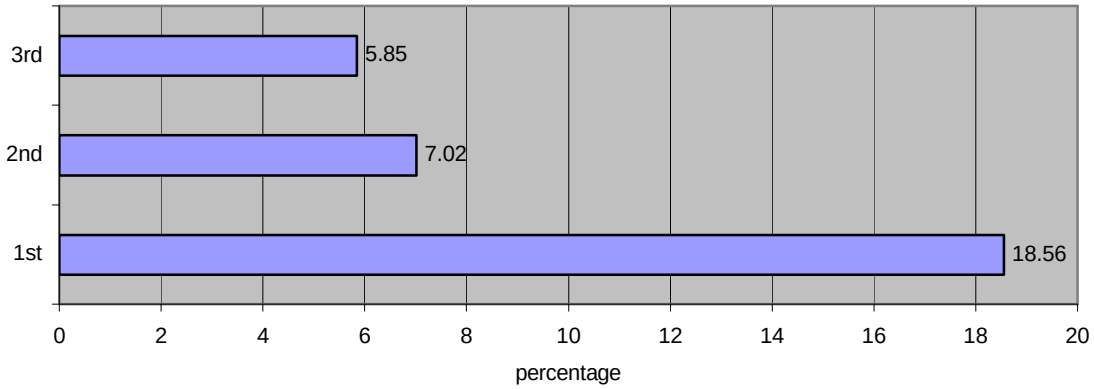
	Alcohol Use n = 101	Alcohol Use % (SE)
Used drugs (n = 54)	23	49.38 (8.79)
No drug use (n = 811)	78	8.31 (1.32)

Trimester of Pregnancy

In the 2002 cohort, 249 (26.85%, SE 2.31) were in their first trimester of

pregnancy, 352 (43.00%, SE 2.72) in their second, and 260 (30.16%, SE 2.56) in their last. Figure C-10 illustrates the alcohol use rate was highest among pregnant females in their first trimester (18.56%, SE 3.23) compared to respondents in their second (7.02%, SE 1.71) or third (5.85%, SE 2.45) trimester. As with the 2001 cohort, results of a goodness of fit chi square test indicated a significant difference in trimester of pregnancy between pregnant women who reported recent alcohol use and those who had not (chi square (2) = 27.95, p = .0001).

Figure C-10
Rates of Prenatal Alcohol Use by Trimester:
2002 Pregnant Females



Domain 2: Social/Environmental Risk Factors

Government program participation (GOVTPROG)

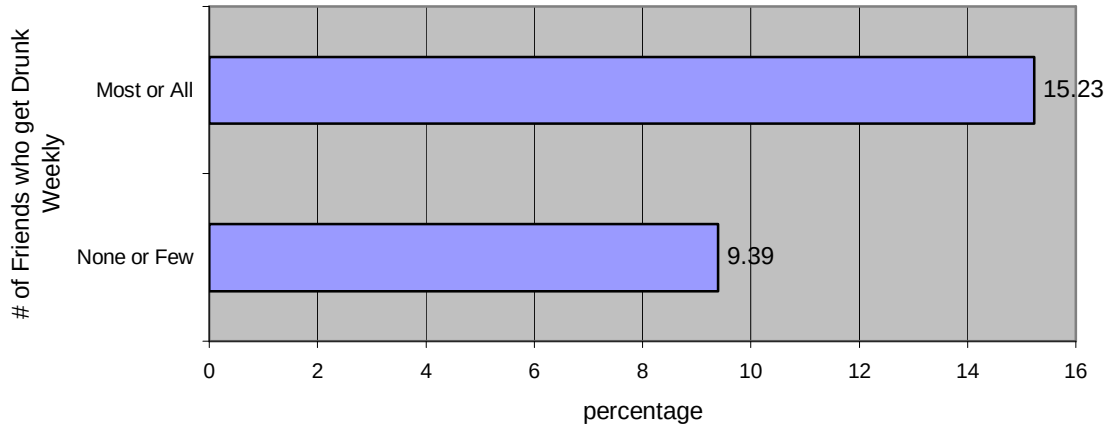
Slightly more than 17% (n = 197) of pregnant females in the 2002 NSDUH indicated they were receiving assistance from at least one government program. Pregnant females who received such assistance had a slightly higher alcohol use

rate (10.15%, SE 2.69) than pregnant females that did not (9.66%, SE 1.53). Results of a goodness of fit chi square test indicated no significant difference in government assistance participation between pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 0.03, p = .8717).

Friends who get drunk at least once a week (DRKFRDS)

One hundred (100) respondents, or 7.54% (SE 0.97), reported that most or all of their friends got drunk at least once a week. As seen in Figure C-11, pregnant females who reported this had higher rates of alcohol use (15.2%) than those who reported that none of few of their friends did (9.4%). A goodness of fit chi square test for this measure between pregnant females who reported recent alcohol consumption and those who did not was not significant (chi square (1) = 2.27, p =.1572).

Figure C-11
Rates of Prenatal Alcohol Use by Friends:
2002 Pregnant Females



Opportunity to buy illegal drugs (APPSELDG)

Ninety-six (96) pregnant females in the 2002 survey indicated someone selling drugs had approached them in the past month. Pregnant females who indicated they had a recent opportunity to buy drugs had a higher alcohol use rate (25.11%, SE 5.89) than pregnant females who reported they had no such opportunity (8.65%, SE 1.37). A goodness of fit chi square test indicated a significant difference on this variable between pregnant females who drank alcohol in the past month and those who had not (chi square (1) = 16.63, p = .0002).

Domain 3: Individual Protective Factors

Spirituality (SPIRITLY)

Pregnant females who indicated that religious beliefs influenced their decisions (n = 620) had lower rates of alcohol consumption (9.03%, SE 1.56) than pregnant females indicating that religion was not important (n = 238) in their life (13.07%, SE 2.82), but no significant difference on this measure of spirituality between pregnant women who reported recent alcohol consumption and those who did not was found (chi-square (1) = 2.63, p =.1829)

Insurance coverage (ANYHLTIN)

Among pregnant females in the 2002 NSDUH, just under 8% (n = 94) indicated they did not have health insurance coverage. Similar rates of alcohol use were seen among pregnant females with health insurance (9.67%, 1.45) and

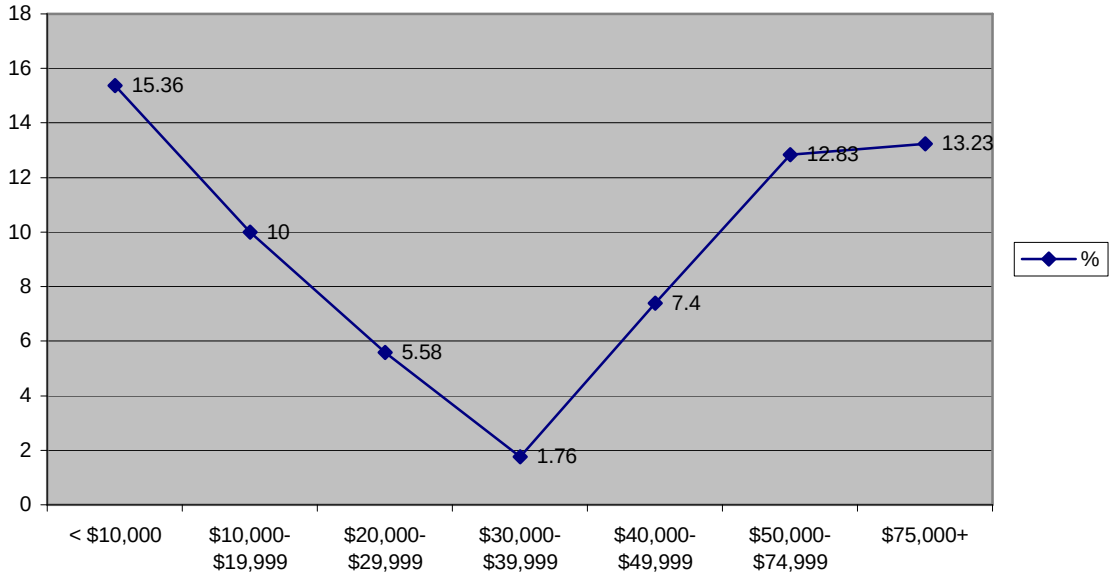
those without health insurance (10.69%, 3.03). There was no significant difference in insurance coverage status between pregnant women who drank alcohol in the past month and those who did not (chi square (1) = 0.07, p = .7550).

Domain 4: Social/Environmental Protective Factors

Income (IRFAMIN3)

As seen in Figure C-12, pregnant females with the lowest annual household incomes had the highest rates of recent alcohol use (15.36%, SE 4.24), followed by those with the highest incomes (13.23%, SE 4.04). Pregnant females with the lowest alcohol consumption rates had incomes between $30,000 - $39,999 (1.76%, SE 0.90) and $20,000-$29,999 (5.58%, SE 1.82).

Figure C-12
Rates of Prenatal Alcohol Consumption by Income
2002 Pregnant Females



Results of a goodness of fit chi square test indicated a significant difference in annual household income between pregnant females who reported recent alcohol use and those that did not (chi-square (6) = 17.79, p = .0446). The largest difference in rates of consumption were between respondents with household incomes between $30,000 - $39,000 (1.76%) and those with incomes below $10,000 (15.36%).

Employment Status (EMPLYD)

As seen in Table C-22, similar rates of recent alcohol use were seen among pregnant females regardless of employment status. A goodness of fit chi square test indicated no significant difference in employment status between pregnant females who had recently consumed alcohol and those who had not (chi square (1) = 0.009, p = .9251).

Table C-22
"Rates of Prenatal Alcohol Consumption by Employment Status
2002 Pregnant Females"

	Alcohol Use n = 101	Alcohol Use % (SE)
Employed (n = 457)	54	9.88 (2.05)
Unemployed (n = 408)	47	9.62 (1.80)

Supportive friends (SNFCONC)

Table C-23 shows rates of alcohol use were highest among pregnant females who reported they had six or more close friends with whom they shared personal issues and concerns (12.8%), followed by those with a single close friend

(10.8%). Respondents with no close friends (8.2%) and those with two or three close friends (9.0%) reported the lowest alcohol use rates. Results of a goodness of fit chi square test indicated no significant difference on this indicator between pregnant women who report recent alcohol consumption and those who did not (chi square (4) 4.94, p = .9338).

Table C-23
"Number of Close Friends by Consumption Status
2002 Pregnant Females"

	Alcohol Use % (SE)
None	8.24 (3.13)
1	10.78 (3.60)
2 or 3	9.00 (2.07)
4 or 5	9.88 (3.12)
More than 5	12.76 (6.07)

Descriptive Summary of 2002 Cohort

As noted earlier, no significant differences were found between the two cohorts of pregnant females on a number of demographic variables. Like their 2001 counterparts, pregnant females in the 2002 NSDUH were predominantly Non-Hispanic White (61%), married (64%), and employed (54%). The vast majority of pregnant females reported having health insurance (92%) and that spirituality was an important influence in their life (79%).

The alcohol use rate among 2002 cohort (12%) was slightly lower than

that of the 2001 cohort (14%). As with 2001 respondents, during the month prior to the survey, between 4% and 5% of pregnant females engaged in binge drinking and illicit drug use, 18% smoked cigarettes, and almost 7% reported having been approached by someone selling illegal drugs.

Pregnant females in the 2002 cohort who reported alcohol consumption within the past month were compared to those who did not drink any alcohol on a number of predictors. The findings from these comparisons are summarized in Table C-24.

Table C-24
"Summary of Bivariate Comparisons:
2002 Pregnant Females"

Characteristic	Chi square value	p value
Domain 1: Individual Risk Factors		
Ethnicity, 7 categories	12.4029	p = .2337
Ethnicity, White vs. Non-White	8.5004	p = .0102*
Age	0.8911	p = .4771
Marital status	2.4805	p = .2159
Mental health problems	.0507	p = .8611
Alcohol abuse or dependence	15.4526	p = .0019**
Cigarette use	40.8154	p = .0000***
Illicit drug use	49.38	p = .0000***
Trimester	27.9507	p = .0017**
Domain 2: Social Environmental Risk Factors		
Government program participation	0.0341	p = .8717
Friends who get drunk regularly	2.2679	p = .1572
Opportunity to buy illegal drugs	16.6285	p = .0002***
Domain 3: Individual Protective Factors		
Spirituality	2.6289	p = .1829
Health insurance coverage	0.0751	p = .7550
Domain 4: Social/Environmental Protective Factors		
Income	17.7954	p = .0446*
Employment status	0.0088	p = .9251
Close friends	1.3146	p = .9338

* significant at .05 level **significant at .01 level ***significant at .001 level

A significant difference between pregnant females who consumed alcohol and

those who did not was seen on one protective factor (income), which was not found in the 2011 cohort. Significant differences in the 2002 cohort were also found on a number of risk factors including the dichotomous ethnicity variable, although a significant difference was not detected on the non-collapsed ethnicity variable. Like the 2001 cohort, significant differences were also detected on:

- alcohol abuse or dependence, with those having either diagnosis reporting higher rates of use;
- cigarette smoking, with smokers reporting higher rates of use; and
- illicit drug use, with drug users reporting higher rates of use.

Unlike the 2001 cohort, no significant difference was seen on age. Trimester of pregnancy, which was added to the model based on findings from 2001 analyses, was significant, with respondents in the first trimester more likely to drink than those in the second or third.

Additional descriptive variables of binge drinking and heavy drinking also indicated significant differences between respondents who reported recent drinking and those who did not. As noted earlier, these variables would perfectly predict the dependent variable (ALCMON – any drinking in the past month), so they were not be added to the model.

Testing the Risk-Protective Model: 2002 NSDUH

All Pregnant Females

Results of regression models with all pregnant females in the 2002 cohort

are seen in Table C-25. Like results of the 2001 analysis, the model was statistically significant at each step and the addition of individual protective (Block 2) and social/environmental risk (Block 3) factors had little impact on the model R^2 value. The addition of social/environmental factors increased the model R^2 value by slightly more than 1%, with variables in the final model explaining almost 18% of prenatal alcohol consumption. Based on the R^2 value, the strength of the relationship between the independent variables and the dependent was moderate at each step.

Table C-25
"2002 Logistic Regression Findings:
All Pregnant Females"

	Domain 1	Domains 1, 2	Domains 1, 2, 3	Full Model
R^2	.1576	.1589	.1641	.1759
Δ in R^2	N/A	+.0013	+ .0052	+ .0118
p of model	p < .001	p < .001	p < .001	p < .001
Significant Coefficients $p \leq .05$	ETHNIC CIGMON SUMMON NEWTRIM	ETHNIC CIGMON SUMMON NEWTRIM	ETHNIC CIGMON SUMMON NEWTRIM	ETHNIC CIGMON SUMMON NEWTRIM IRFAMIN3
# of cases	793	787	779	779

Significant Predictors among 2002 Pregnant Females

Table C-26 contains more information on those variables that remained statistically significant in the full model. The most influential predictors was SUMMON, with pregnant females who used illicit drugs in the past month almost

6 as likely to drink alcohol compared to non-drug users. Respondents that smoked cigarettes (CIGMON) during the past month were almost 4 times as likely to consume alcohol and respondents in their first trimester were 3 times as likely to report recent drinking. Although income was conceptualized as a protective factor, respondents with higher incomes were more likely to drink during pregnancy.

Table C-26
"2002 Statistically Significant Predictors:
All Pregnant Females"

	B	SE	95% CI	t	P	Odds Ratio
Individual Risk: ETHNIC	.69	.363	-.023 1.404	1.90	.058	1.99
CIGMON	1.34	.432	.493 2.187	3.11	.002	3.82
SUMMON	1.77	.469	.849 2.691	3.77	.000	5.87
NEWTRIM	1.10	.355	.408 1.800	3.11	.002	3.02
Individual Protective: None	---	---	---	---	---	---
Social/Env Risk: None	---	---	---	---	---	---
Social Env Protective: IRFAMIN3	.23	.097	.043 .423	2.41	.016	1.26

Ethnic Comparisons of 2002 Pregnant Females

Table C-27 contains findings from separate regression analyses (full model) of all pregnant females, White pregnant females, and Non-White pregnant females. The overall strength of the White and Non-White models were somewhat stronger than the full model, explaining an additional 5% and 8%,

respectively, of variance than the model with all 2002 respondents. The strength of the relationship between the dependent and independent variables was moderate across all three models.

The statistically significant variables for the subgroup of White respondents (CIGMON, SUMMON, NEWTRIM, IRFAMIN3) did not differ from those of the final model with all respondents. However, there were several differences for the subgroup of Non-White respondents. The predictors of SUMMON, NEWTRIM, and IRFAMIN3 (income) were not significant among Non-White respondents, although NEWAGE and ABODALC (alcohol abuse or dependence in the past year) were. CIGMON was the only predictor that remained significant across all three models.

Table C-27
"2002 Logistic Regression Findings:
Ethnic Comparisons"

	All Pregnant Females	White Pregnant Females	Non-White Pregnant Females
Pseudo R^2	.1759	.2248	.2589
p of model	p < .001	P < .001	p < .001
Significant Coefficients p < .05	ETHNIC CIGMON SUMMON NEWTRIM IRFAMIN3	 CIGMON SUMMON NEWTRIM IRFAMIN3	 NEWAGE ABODALC CIGMON
# of cases	779	475	304

Significant Predictors among 2002 White Pregnant Females

Table C-28 shows that SUMMON (past month illicit drug use) is the most influential predictor among 2002 White pregnant females. White respondents who used illicit drugs were almost 20 times as likely to drink alcohol than non-drug users. White females who smoked cigarettes in the past month (CIGMON) were over 5 times as likely to engage in prenatal alcohol consumption compared to non-smokers. White pregnant females in their first trimester of pregnancy were 4 times as likely to drink than those in their latter two trimesters. Higher annual household income was also associated with greater risk for drinking among White respondents.

Table C-28
"2002 Statistically Significant Predictors:
White Pregnant Females"

	B	SE	95% CI	t	p	Odds Ratio
Individual Risk:						
CIGMON	1.69	.593	.528 2.857	2.86	.004	5.43
SUMMON	2.98	.661	1.680 4.277	4.51	.000	19.66
NEWTRIM	1.39	.440	.529 2.261	3.17	.002	4.03
Individual Protective:						
None	---	---	---	---	---	---
Social/Env Risk:						
None	---	---	---	---	---	---
Social Env Protective:						
IRFAMIN3	0.39	.141	.108 .664	-0.42	.007	1.47

Significant Predictors among 2002 Non-White Pregnant Females

As seen in Table C-29, cigarette smoking in the past month (CIGMON)

was the most influential predictor among Non-White 2002 pregnant females. Cigarette smokers were 9 times more likely to drink alcohol during their pregnancy than non-smokers. Non-White pregnant females with a diagnosis of alcohol abuse or dependence were 7 ½ times as likely to drink during pregnancy than those without either diagnosis. Non-White pregnant females 25 years and younger were slightly more likely to consume alcohol than older pregnant females.

Table C-29
"2002 Statistically Significant Predictors:
Non-White Pregnant Females"

	B	SE	95% CI	t	p	Odds Ratio
Individual Risk:						
NEWAGE	-1.76	.780	-3.293 -.2236	**-2.25**	.025	.17
ABODALC	2.01	.832	.376 3.652	2.42	.016	7.50
CIGMON	2.22	.653	.936 3.508	3.40	.001	9.23
Individual Protective: None	---	---	---	---	---	---
Social/Env Risk: None	---	---	---	---	---	---
Social Env Protective: None	---	---	---	---	---	---

Cross Validation of 2001 Findings

In a cross-validation effort, results from the final regression model of the full 2001 and 2002 cohorts were compared.

Table C-30
"Comparison of 2001 and 2002 Final Regression Models"

	2001 Cohort (N = 949)	2002 Cohort (n = 865)
Pseudo R^2	.1977	.1759
Model significance level	.0000	.0000
Number of observations	819	779
Significant Predictors ($p \leq .05$)	NEWAGE ABODALC CIGMON SUMMON NEWTRIM	ETHNIC CIGMON SUMMON NEWTRIM IRFAMIN3

Although findings from the two survey data sets did not precisely replicate one another, there were a number of similarities across the two final regression models. The strength of both models is moderate, with the amounts of variance in the dependent variable explained within 2% of each other. Both models had the same significance level ($p < .001$) and results were based on observations from approximately 800 respondents. The most noticeable difference between the two models was in the predictors that remained statistically significant in the final models, although three variables (CIGMON, SUMMON, NEWTRIM) were significant for both cohorts.

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Vita

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Upon graduation from the master program, the author moved to Temple to work as a Clinical Social Worker at Scott & White Hospital and Clinic in Temple, Texas. She married Daniel Ray Kotrla on April 30, 1994 and they had a daughter, Danielle Renee Kotrla, on March 27, 1998.

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